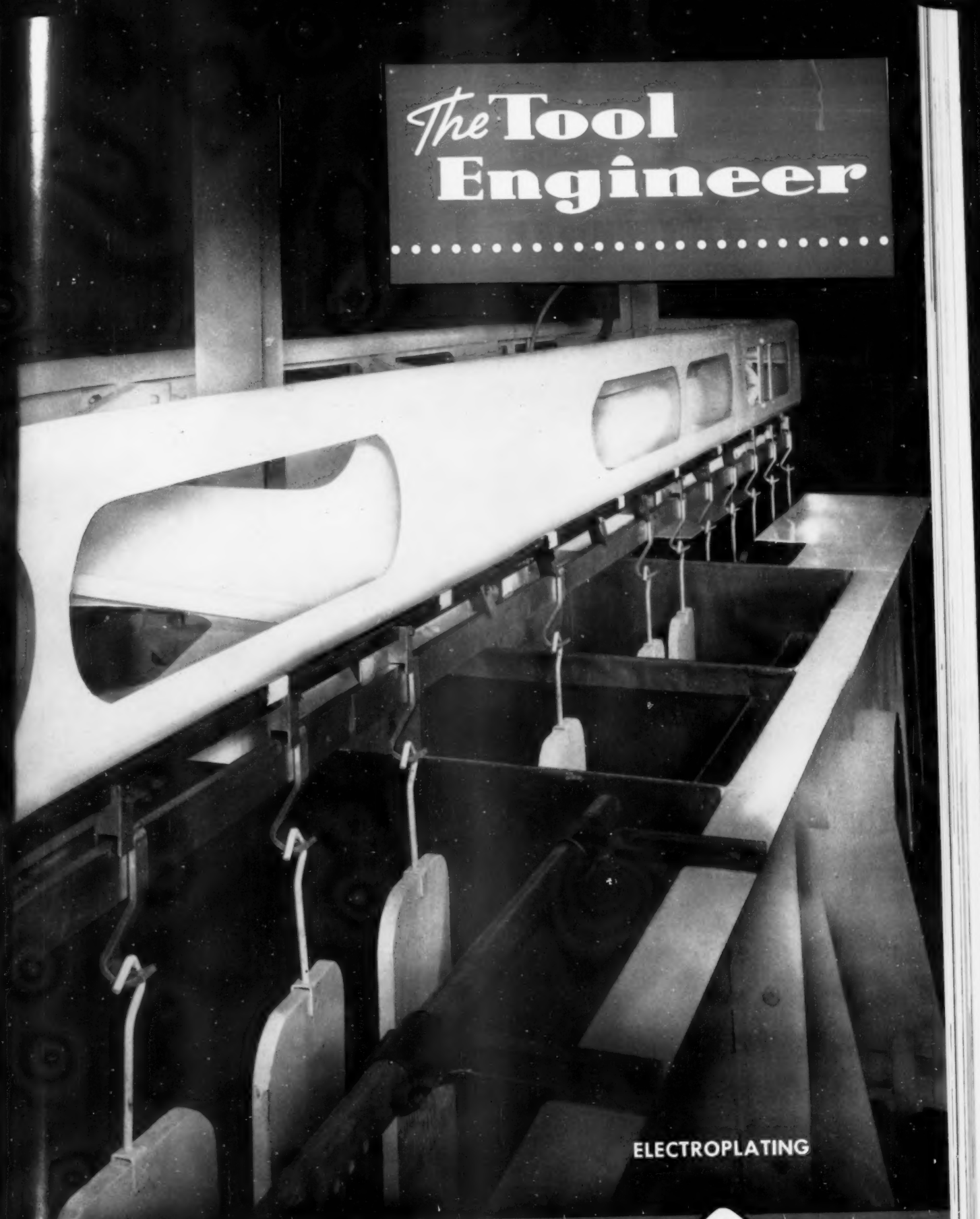


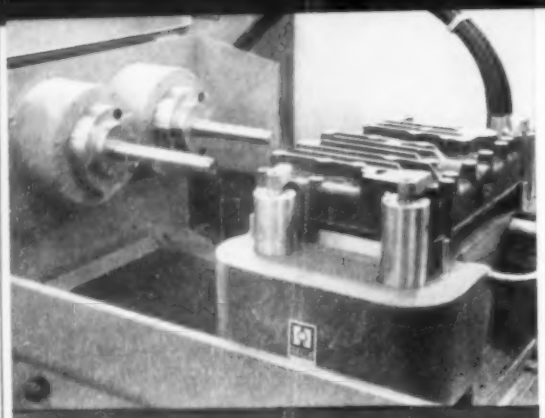
The Tool Engineer

ELECTROPLATING

PUBLICATION OF THE AMERICAN SOCIETY OF TOOL ENGINEERS

JUNE, 1953

PLANNING ENGINEERING CONTROL OF TOOLING EQUIPMENT PRODUCTION



Long valve body holes are successfully bored, two at a time, with damped quills on this Heald Bore-Matic setup. Surface finish is materially improved by damping.

How Inertia Damping

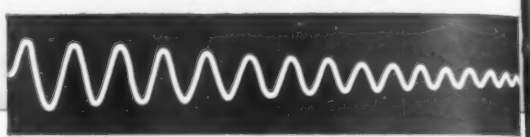
PREVENTS QUILL CHATTER

• Self-excited vibration in relatively long boring bars often presents a serious problem—particularly where a fine finish is required.

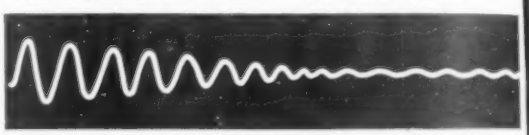
Heald's answer to this problem is the damped quill—a method of vibration control which has proved both simple and remarkably effective in a great many cases.

The damping effect is obtained by means of a plug of heavy material, inserted in the bored-out end of the quill. Being slightly smaller than the bore, the damper plug "floats" in its enclosure as the quill rotates, and its inertia tends to oppose or cushion any vibratory movement of the quill itself. The effectiveness of the damped quill is well illustrated by the microphotographs and oscillograph records shown at the right.

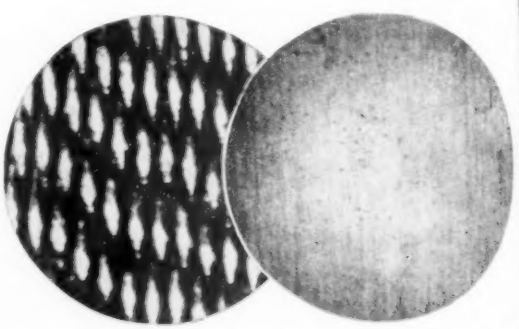
If you have a problem of self-excited quill chatter, ask your Heald representative for the complete damped quill story—or write for our special folder on damped quill applications. Remember—when it comes to precision finishing, it pays to come to Heald.



Oscillograph record showing normal rapidity with which quill vibration tends to die out.



Oscillograph record showing how vibration in a properly damped quill decreases much more rapidly.



Above, at left, is a photograph, magnified 8 times, showing a chattered work surface before damping. At right, with same magnification, the surface finish has been obviously improved by damping the quill.

HEALD

Case Study
No. 2242-96 in
PRECISION PRODUCTION

INTERNAL AND ROTARY SURFACE GRINDING MACHINES AND BORE-MATICS

THE HEALD MACHINE COMPANY

WORCESTER 6, MASSACHUSETTS

Branch Offices: Chicago • Cleveland • Dayton • Detroit • Indianapolis • New York

Cover: Automatic loading and unloading permits the continuous operation of this plating installation. The conveyors are built so that the work-pieces are brought back to a central location, by the Udylite equipment.

The Tool Engineer

Volume XXX, No. 6 **June, 1953**

TECHNICAL ARTICLES

ASTE NEWS

DEPARTMENTS

THE TOOL ENGINEER is regularly indexed in *The Industrial Arts Index.*

AMERICAN SOCIETY OF TOOL ENGINEERS

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THE TOOL ENGINEER
Publication of The American Society of Tool Engineers
10700 Puritan Ave.
Detroit 21, Mich.

The Tool Engineer

Are the Calculations Dependable?

In manufacturing, it is essential to know the tolerences within which a machine can produce economically. Tolerances are likewise present in almost all calculations and it is important that the assumptions made in calculations be understood so that the results are within the tolerances required.

Handbook formulas are often criticized unfairly. No formula should be employed by an engineer unless he is familiar with its derivation. Only when the assumptions made in developing a formula are known can an engineer have full knowledge of the tolerances in his calculations and predict with certainty the applicability of his data.

Formulas do not allow for the accumulated errors in a mechanism, the exact application of a force, the effects of friction, the deflections in a system, and many other considerations that cannot be evaluated. Nevertheless, calculations are essential to engineering and their intelligent application is responsible for the unusually fast strides that have been made in the profession.

When calculations are based upon methods of approximation, the problems are complicated further. As an example, the usual calculations of tolerances when using the circular arc method for approximating involute forms is a tedious task. Further, the assumptions in the method usually magnify the error. If trial and error methods are employed there is no way to determine if the best combination of pivot location and radius is obtained.

In a specific case, the manufacture of a large broach was considered impossible by the circular arc method because the calculations indicated excessive errors in form. Deviation tables, however, which are published in Mr. Silvagi's article beginning on Page 15 quickly showed that the broach could be produced within the manufacturing tolerances specified. This broach is now in successful operation.

John W. Greve

EDITOR

DIALIZE and ECONOMIZE

Any AGD Adjustable Limit Snap Gage becomes a DIAL INDICATOR Snap Gage with a STANDARD Dializer

Patented

Simplicity Itself!...

By removing a pair of pins from the snap gage and inserting a STANDARD Dializer any make of AGD Snap Gage in any model, A, B or C, is instantly converted to a DIAL Snap Gage. Dializer is easily transferred from one frame to another.

Dializers are available for complete range of AGD Adjustable Limit Snap Gages (MODELS A, B or C)

No. 1 fits AGD Frames 1 thru 6
No. 2 fits AGD Frames 7 thru 10
No. 3 fits AGD Frames 11 thru 16

No. 3 Dializers also fit larger size frames beyond AGD size range (available from STANDARD) for dimensions up through 26⅝".

ACCURACY ASSURED by double reed principle.

RANGE OF ADJUSTMENT of gage is unaffected.

INDICATOR either with .0001" graduations and .005" range, or with .001" graduations and .025" range.

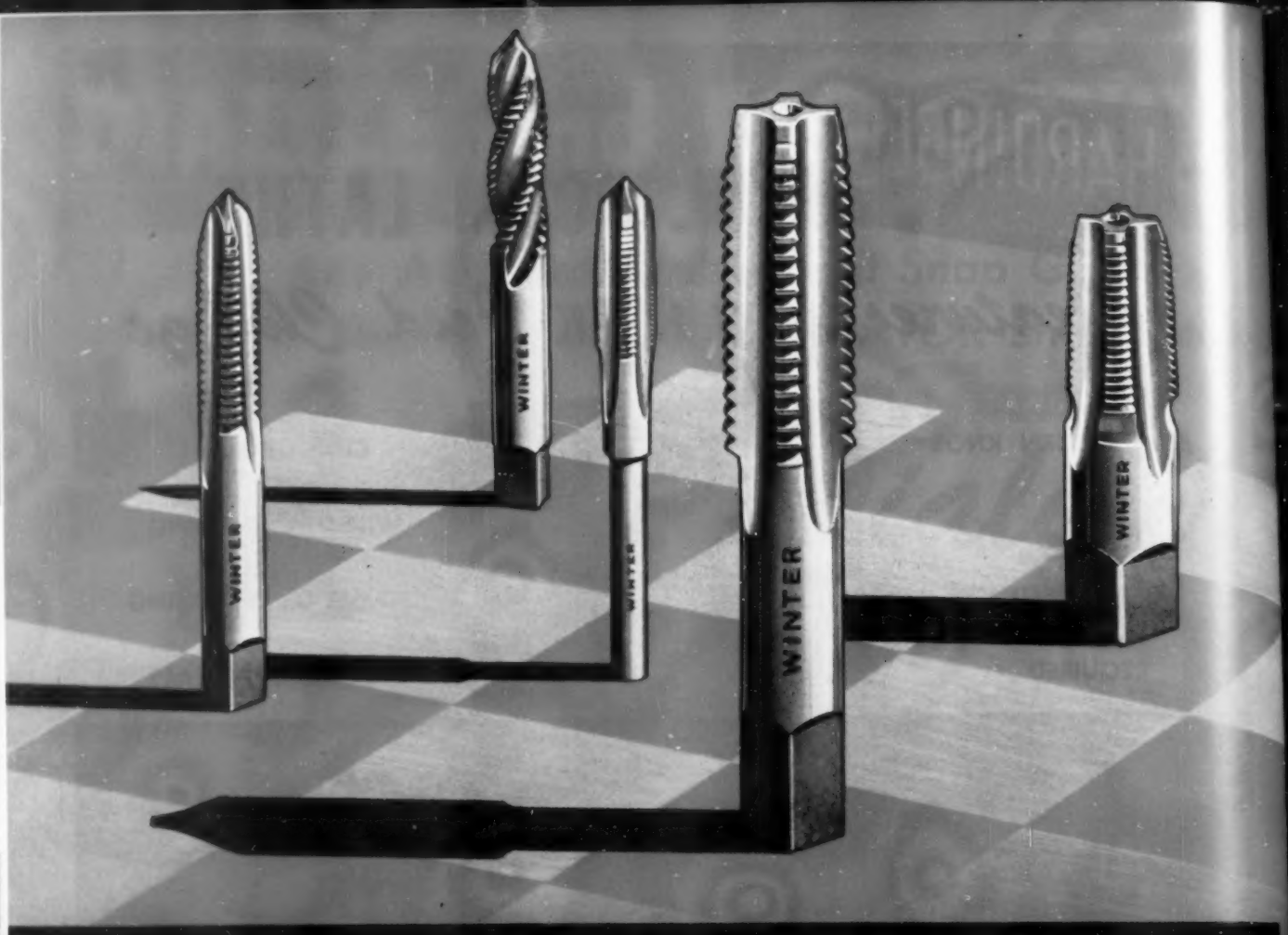
We can supply snap gage frames if you do not already have them. Tungsten carbide contact points, anvil blocks and snap gage pins are also available.

Write Today for Your Copy of Catalog C

Dialize Your LENGTH GAGES, too!

Dializers can also be used on any AGD Adjustable Limit Length Gage, Progressive Type for internal or external measurements.

STANDARD GAGE CO., Inc., Poughkeepsie, N.Y.

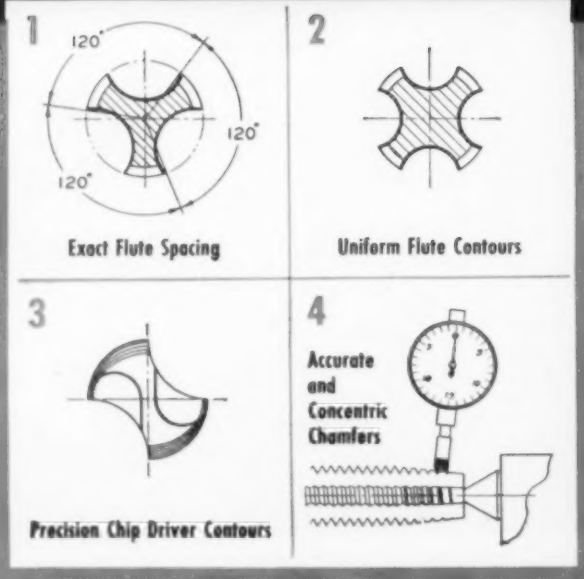


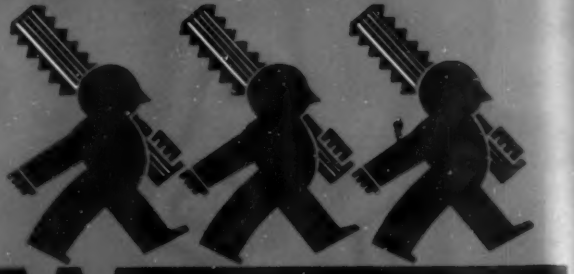
Get These 4 Advantages of

BALANCED Action

BALANCED ACTION results in tapped holes of uniform and accurate sizes; minimum scrap losses; and money saved through longer tool life.

ALWAYS AT YOUR SERVICE
Your local Industrial Supply Distributor carries a complete stock of WINTER Taps.





WINTER

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Division of National Twist Drill & Tool Co.

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Buy National milling cutters with their dependable cutting edges. Let National specify a design exactly suited to the work they must do . . . You'll get the edge in peak production, smooth operation, and long wear.

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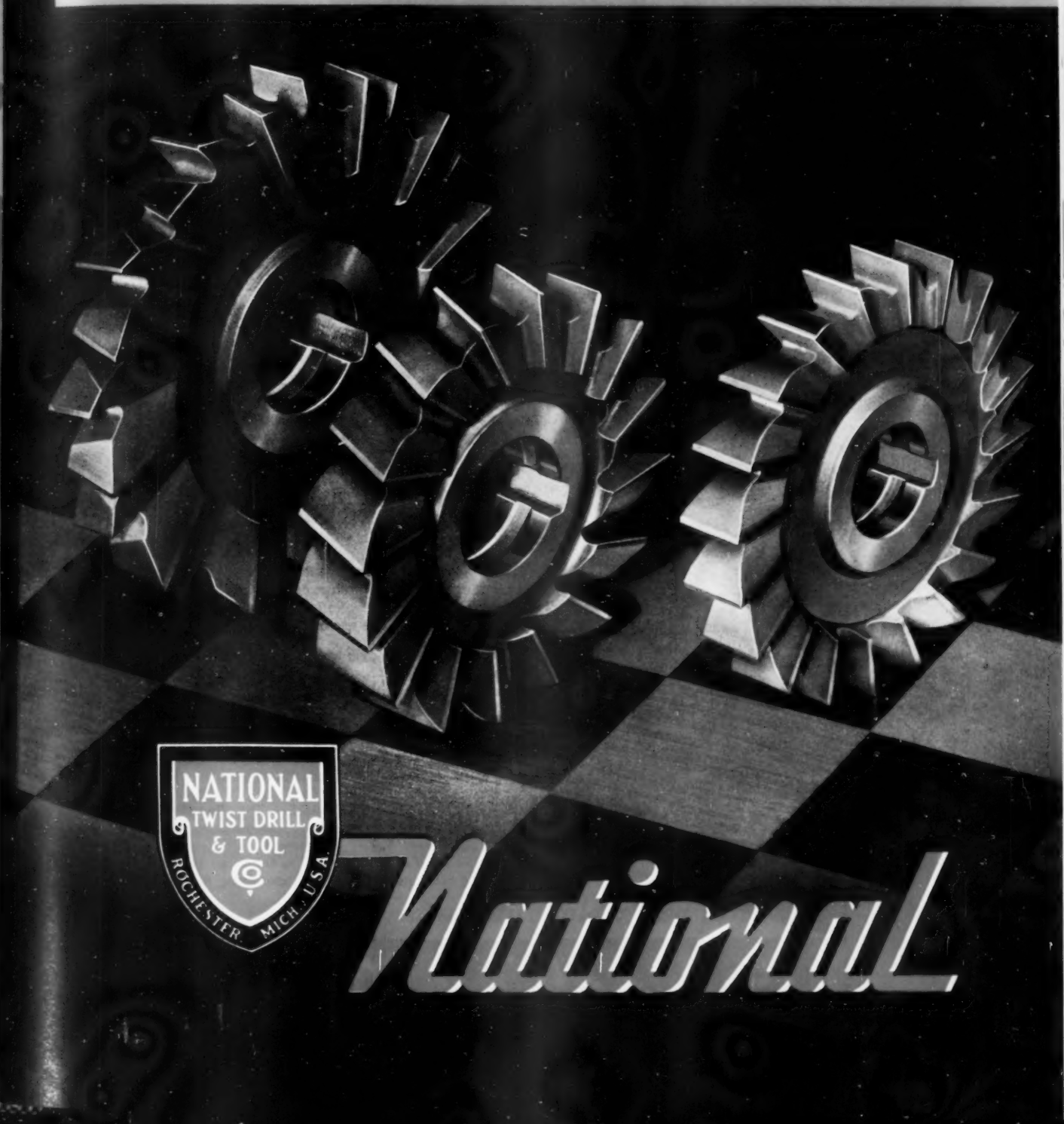
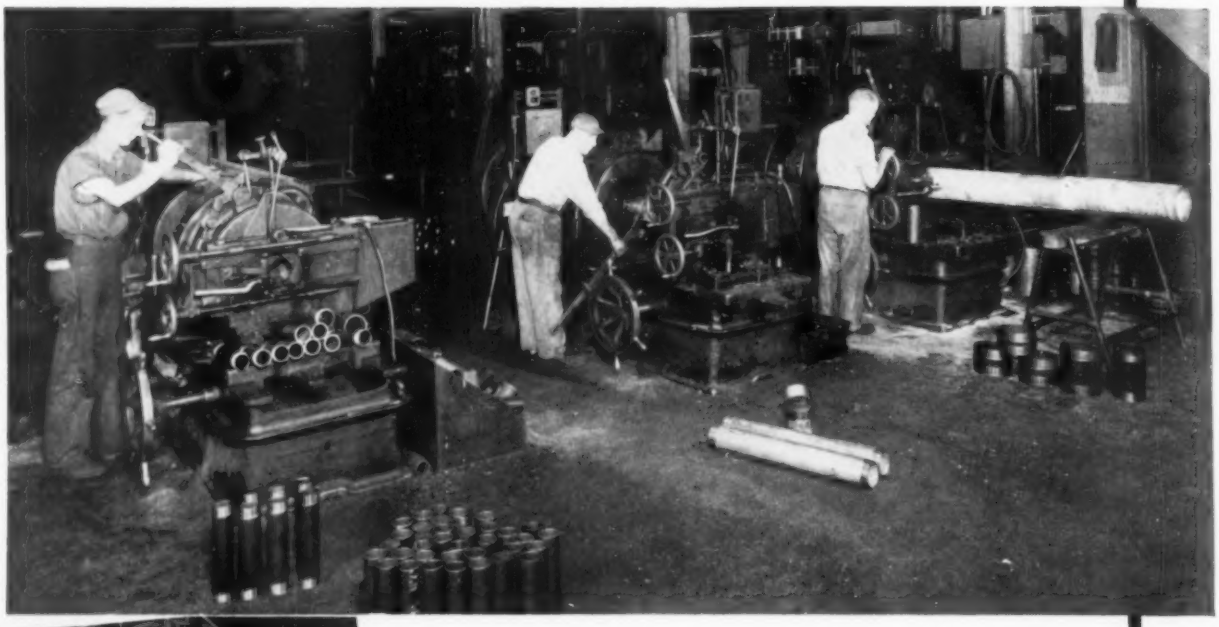


LANDIS PIPE THREADING MACHINES



. . . 4 Major Features Increase Efficiency

1. WIDE RANGE—Just three LANDIS Pipe Machines (2", 8" and 18") will thread all diameters of pipe from ½" to 18". Each machine is constructed so as to handle a wide range of pipe sizes—for example, the 6" machine will thread all diameters from 1" to 6". Universal size adjustment allows quick set-up.

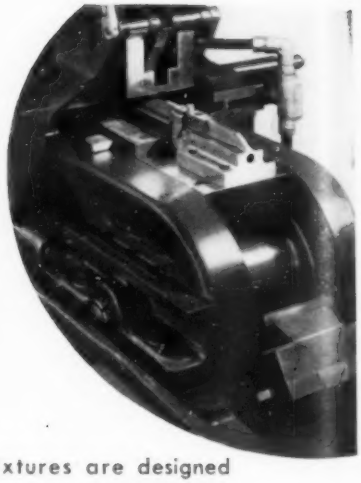
2. DIE HEAD EFFICIENCY—The design of Stationary heads provides maximum rigidity on all diameters within their range. Positive locking action is assured through a self-locking toggle joint. Size adjustment is quickly and easily obtained through the use of a single locking nut.

3. LOW TOOL COST—Chasers operate at a tangent to the work. Line contact at cutting edge reduces friction. Permanent throat assures even chip distribution. Variable rake affords proper cutting edge for different materials. Landis chasers are useable for 80% of their original length. They are individually replaceable and, within the range of a given die head, a single set can be used for all diameters of the same pitch, form and taper.

4. PRECISION TAPERED THREADS—The Receding Chaser Pipe Machines are especially designed to cut tapered threads to meet A.P.I. requirements. Chasers recede into the die head at a rate equal to the taper of the thread, ensuring accurate and uniform taper along the full thread length.

50TH ANNIVERSARY

LANDIS *Machine* CO. WAYNESBORO PENNSYLVANIA



to cut
machining costs
machine faster
with
continuous
broaching

• Holding fixtures are designed for quick, convenient loading, with automatic clamping and unclamping.

Many types of work can be surface broached on Footburt machines at remarkable savings over previous machining methods. High production is obtained with required accuracy and finish. Cutting tool maintenance costs are low. We will be glad to make our recommendations on Footburt Surface Broaching Machines based on our many years in handling similar work.

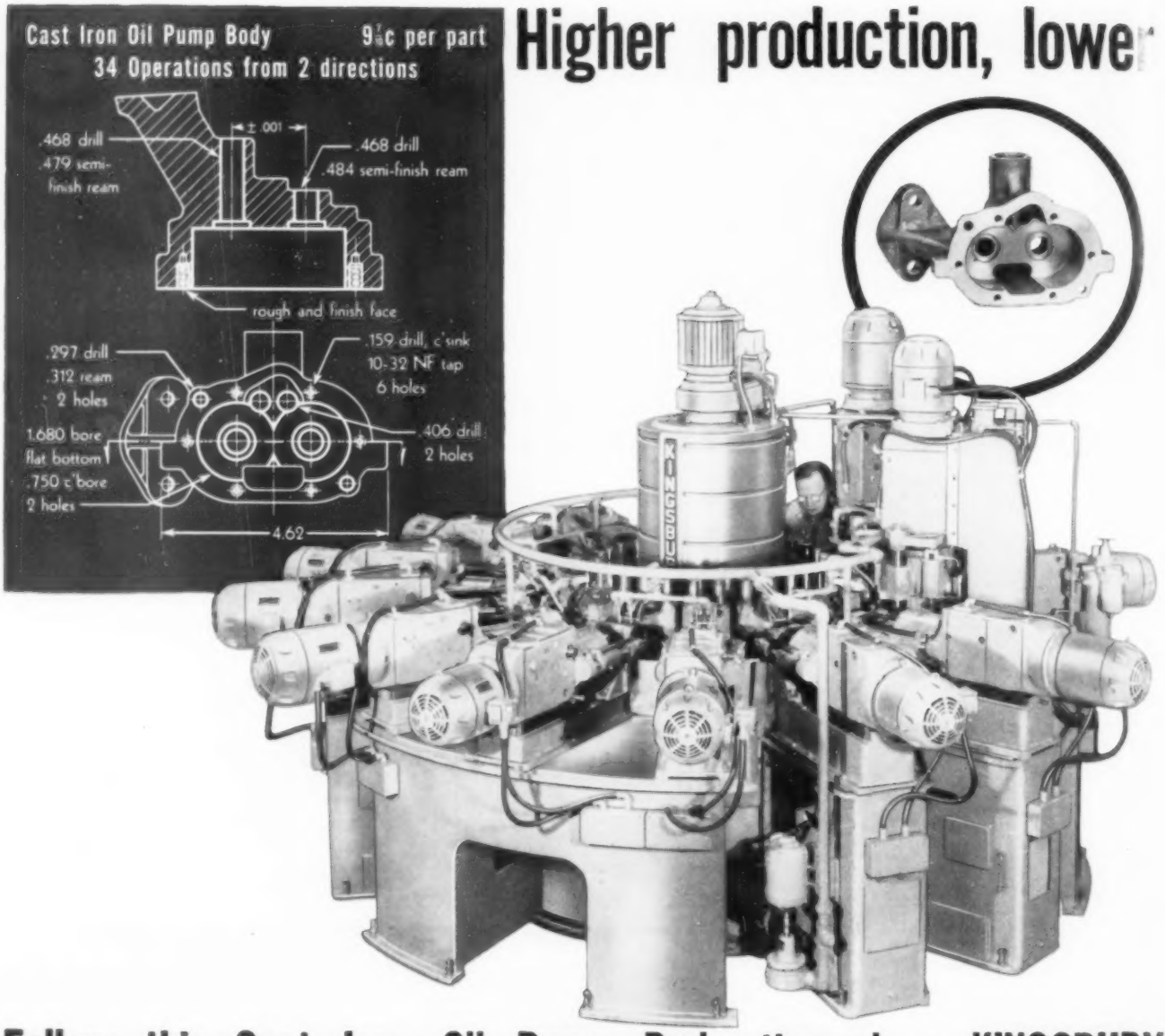
THE FOOTE-BURT COMPANY, Cleveland 8, Ohio

Detroit Office: General Motors Building

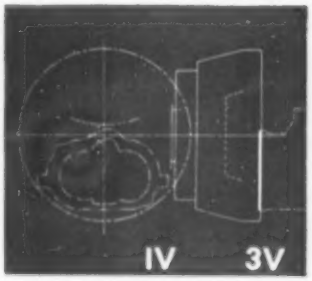
FOOTBURT

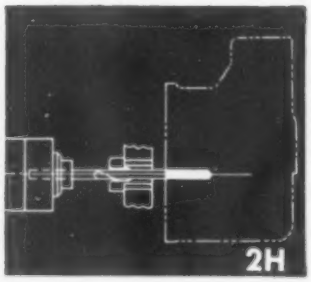
MACHINE TOOLS

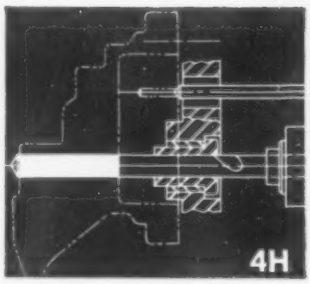
Higher production, lowe

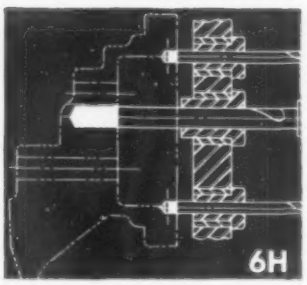


Follow this Cast Iron Oil Pump Body through a KINGSBURY









This Kingsbury accomplishes 34 operations from two directions. It mills, drills, bores, c'sinks, reams and taps. Used by a leading automotive manufacturer for a cast iron oil pump body, it produces 200 parts per hour gross; has a central column with an 84-inch base and a 60-inch index table with 14 stations. Of the 13 units, two are vertical (V) and 11 are horizontal (H). Eight of these units have multiple spindles.

Thirty-four operations are accomplished by one man on this one machine. Follow through and see:

Unit 1-V (Station 1 vertical) rough mills the base of the large flange. This milling operation employs our heaviest milling unit: about as large as we care to handle.

Unit 2-H with six-spindle head drills six .159 holes .74 deep.

Unit 3-V finish mills the face.

Unit 4-H countersinks three of the .159 holes and drills a .453 hole.

Unit 5-H countersinks the remaining three .159 holes and drills a .438 hole.

Unit 6-H drills a .406 hole and two .297 holes.

At *Unit 7-H* another .406 hole is drilled and the .297 holes are .312 reamed.

Costs, soon pay for a Kingsbury

Combined operations on a Kingsbury bring you distinct advantages.

You benefit from the combined operations of a Kingsbury special purpose production machine. Output per man hour is increased. The part is not moved after once being chucked. It travels through a work cycle where units of from ½ to 5 hp each drill, ream, c'bore, mill, tap, thread, etc., accurately and automatically.

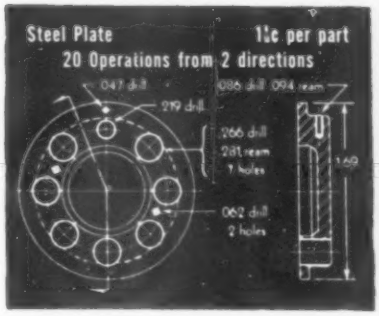
These combined operations cut production costs. Only one operator is required. He loads and unloads the machine. Handling of each part is reduced to this one chucking operation. There is almost no scrap loss — each part is machined uniformly to specifications. Less floor space is required than for separate machines.

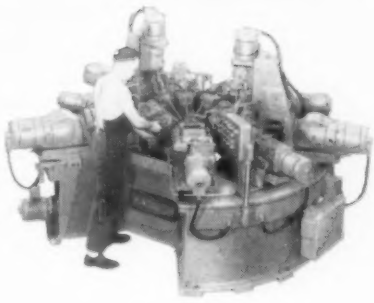
If you are interested in further information on these special purpose machines, we'd be pleased to hear from you.

Kingsbury Machine Tool Corp.,
101 Laurel St., Keene, N. H.

KINGSBURY

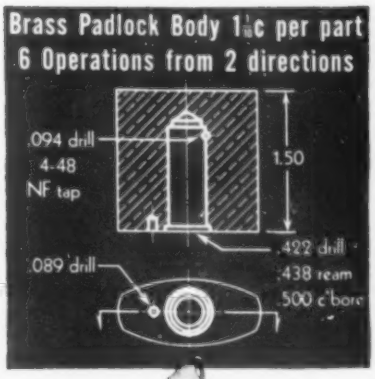
AUTOMATIC DRILLING AND TAPPING MACHINES
for Low-Cost High Production

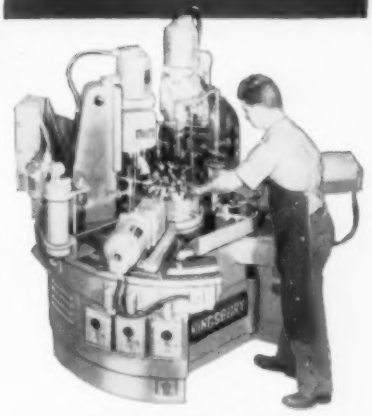




Steel Plate
540 parts per hour gross
1 6/10¢ per part

This part measures only 1.69 OD, and contains 12 holes. Most of these are partial holes. The machine has two Vertical Units and nine Horizontal Units operating 20 spindles in all. Close center distances prevent the use of more than two spindles at any one unit. Rigid tolerances must be held.

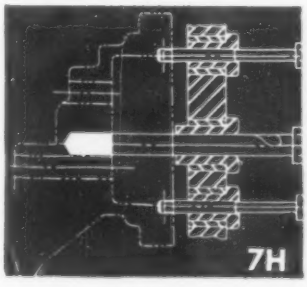


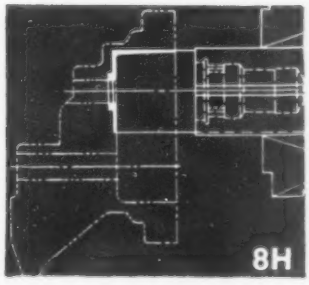


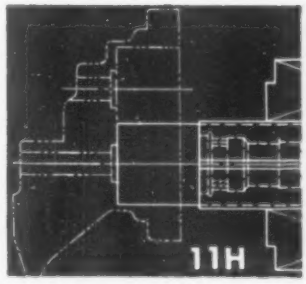
Brass Padlock Body
460 parts per hour gross
1 1/10¢ per part

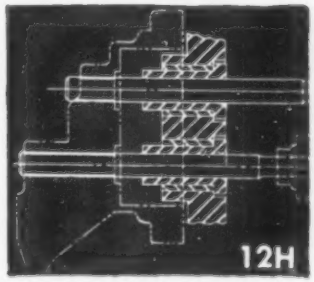
This is a comparatively simple machine with six operations, four horizontal, two vertical. It drills, c'bores, reams and taps — all automatically. The machine is compact with 60" diameter base, 12" diameter index table, six fixtures and six drilling units. Bushings guide drills and reamers.

as it produces 200 parts per hour gross at 9 7/10c each









Units 8-H, 9-H, 10-H, 11-H

Here we work on the thru-holes and large bores with combination tools; really the most interesting operations. Drawings 8-H and 11-H illustrate these operations. A 1.680 hole is rough bored at both Unit 8-H and 9-H, each with a flat bottom and .750 c'bore. These two 1.680 holes then receive a semi-finished bore with flat bottom at Units 10-H and 11-H.

Unit 12-H. The .484 holes bored at 4-H and 5-H receive a semi-finished ream.

Unit 13-H with six 10-32 NF taps performs the tapping operation in the six holes drilled by Unit 2-H.

Operator stands at the 14th station when he loads and unloads the machine. An air cylinder clamps and unclamps the work fixtures.

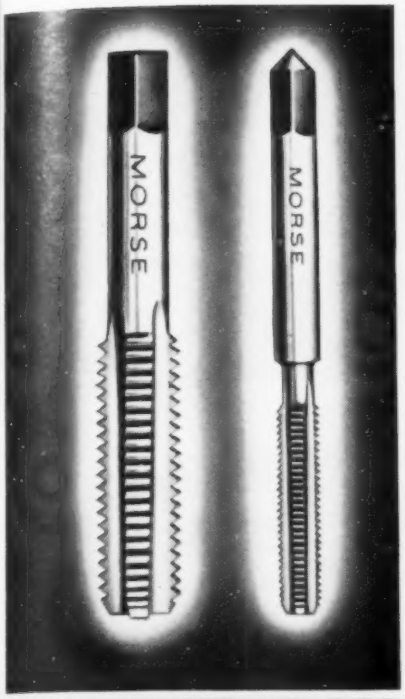
Each Unit Cost on the drawings includes the cost of the man and of the machine — no power or overhead. We assumed:

Unit cost of man equal to:

$$\frac{\text{average U. S. hourly wage}}{\text{hourly gross x 80\% efficiency}}$$

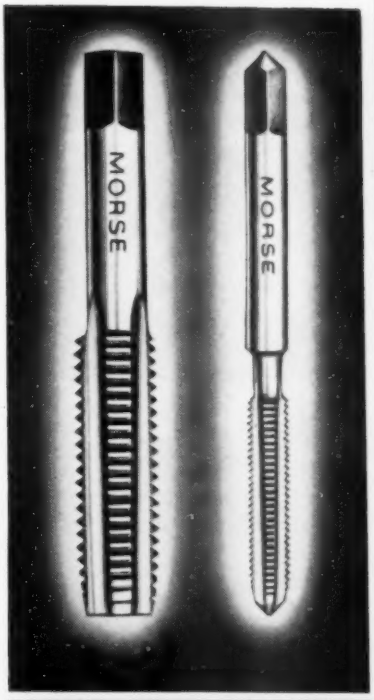
Unit cost of machine to be:

$$\frac{\text{price of tooled machine}}{\text{output in 6000 hrs. @ 80\% efficiency}}$$



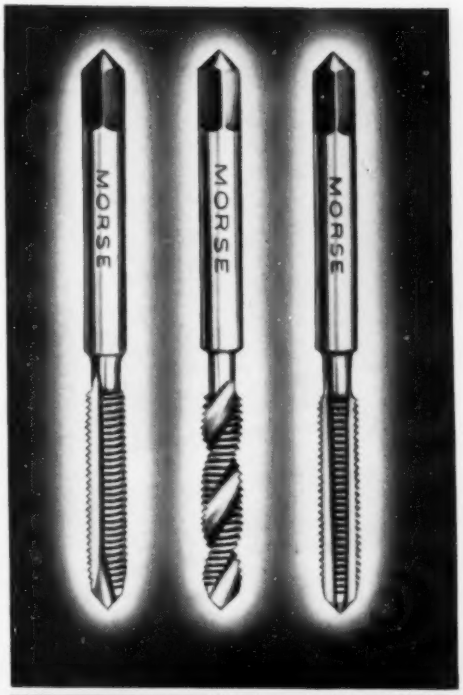
For Brass or Cast Iron

For use in these and other materials with *brittle-chip* characteristics . . . in hand, machine-screw, and taper-pipe styles. Made with radial face (0 degrees rake — see drawing at right below) and surface-treated to resist abrasion and loading. High-speed steel with commercial ground threads only, except for pipe taps (also furnished with cut threads.)



For Aluminum or Stainless Steel

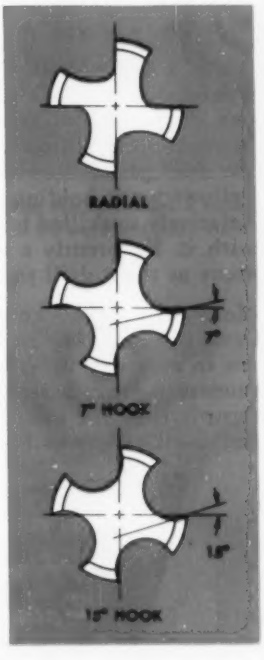
For use in these and other materials with *stringy-chip* characteristics . . . in hand, machine-screw, and taper-pipe styles. Made with a 15-degree hook (see center drawing at right below) and commercial ground threads, in high-speed steel only.



Oversize Machine-Screw Taps

For use in materials like plastics or zinc alloys, *where difficult to maintain proper tapped-hole size* . . . because of the material's abrasive properties or its tendency to shrink, *after tapping*. Made in certain sizes only . . . in straight-flute . . . spiral point . . . and spiral flute styles. Regularly furnished .002″ over standard commercial ground-thread limits. Surface-treated to resist abrasion.

HERE'S THE BIGGEST TAP NEWS IN YEARS . . . and as usual it comes from Morse. These new Special-Purpose Taps . . . set new standards of performance and long life. Get the whole story on this new Morse line *direct and in person* . . . from your experienced Morse-Franchised Distributor, who is always at your service. He has an important new free booklet for you . . . giving complete details on these new Morse Special-Purpose Taps, and full information on the new Unified Threads.



MORSE TWIST DRILL & MACHINE COMPANY
NEW BEDFORD, MASSACHUSETTS

(Division of VAN NORMAN CO.)
Warehouses in New York, Chicago, Detroit, Houston, San Francisco

Cutting Tools

Bellows
DRILL PRESS FEED

TURNS HAND-FED DRILL PRESSES INTO AUTOMATIC DRILLING MACHINES . . .

The Bellows Drill Press Feed attaches to the star wheel shaft of any standard drill press. At a touch on the operating handle the Feed advances the spindle rapidly to the work, feeds the drill into the work at an exactly controlled feed rate and thrust; and, when the drilling stroke is completed, automatically returns the spindle to starting position, and stops. Easily accessible controls provide accurate feed rate adjustments for any tool working in any material, at the breakthrough or at any pre-determined point.

The Bellows Drill Press Feed is inexpensive. Prices start at $164.00. It can be transferred from one drill press to another in less than half an hour. It doesn't interfere with hand operation of the drill press. It can be readily synchronized to Bellows work holding and work feeding devices. Relatively unskilled help can do top quality work with it. Frequently a single operator can run as many as three drill presses.

More than 10,000 companies use Bellows Drill Press Feeds. In some plants as many as 400 Feeds are in everyday use—drilling, tapping, reaming, counter boring, threading—building production records that are hard to believe unless you use Bellows Drill Press Feeds yourself.

- **INSTALLS IN LESS THAN HALF AN HOUR**
- **OFTEN DOUBLES, EVEN TRIPLES, PRODUCTION**

WRITE TODAY FOR *Free* BOOKLET

16 pages of facts on how you can use Bellows Drill Press Feeds to cut your drill press costs to a new low.

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The Bellows Co.

AKRON 9, OHIO

755A

Controlled-Air-Power

FOR FASTER, SAFER, BETTER, AND *LOWER* COST PRODUCTION

Production Pointers from GISHOLT

GISHOLT

TIME-SAVING IDEAS

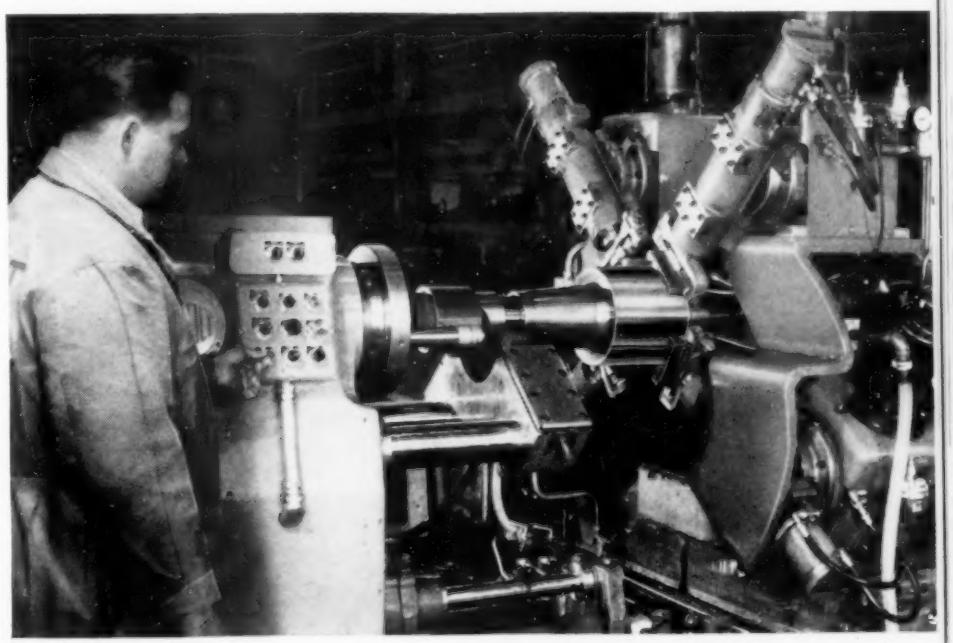
Presented as a service to machine shops, we hope some of these interesting ideas, culled from thousands of jobs, will suggest ways to help you cut time and costs in your own metal work.

NOW, FOUR TIMES THE SURFACE LIFE FOR THESE MILL ROLLS

Yet SUPERFINISH Achieves It In Half the Time

Where you have parts requiring the finest possible surface smoothness, Superfinish saves time and gives you better, longer wearing surfaces. You can bank on it!

Here, Superfinish is at work in the steel industry—finishing mill rolls used for producing stainless steel strip. The machine, a Model 78 Mill Roll Superfinisher handles a variety of these rolls in a fully automatic cycle.



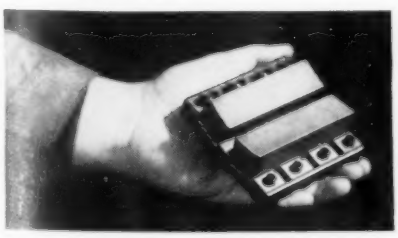
Superfinisher has fully automatic cycle. After loading, operator merely presses a button; the spindle then drives the roll, and the finishing heads move up to the work and begin oscillating.

Here's how it saves:

Finishing—Rolls are brought down from 15-20 to 1-2 micro inches RMS by Superfinishing. A roll 36 inches long by 20 inches in diameter requires just 15 minutes to finish . . . less than half the time for grinding.

Longer Life—The Superfinished surface is base metal, not the soft, annealed "smear metal" produced by grinding heat. Experience has proved that this harder, better wearing surface gives the rolls *more* than four times the service life of those finished by the old method.

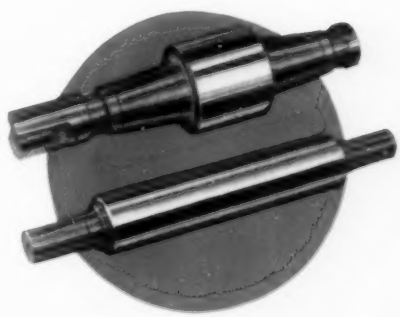
Reduced Buffing—The Superfinished rolls leave a much finer surface and the stainless strip requires far less buffing to obtain the desired reflective surface.



Quick-change stoneholder, with two Superfinishing stones, as used on each of four heads.

These basic advantages of Superfinish—better, longer lasting surfaces that cost less—can be applied to your problems involving cylindrical surfaces. Ask for the reprint, "Mill Roll Superfinisher," which tells the complete story. We will also be glad to send you a free copy of the most authoritative textbook on this modern process, entitled, "Wear and Surface Finish."

Superfinishing gives these mill rolls smoother, longer lasting surfaces, and produces them in less than half the time required by grinding.



Roll surfaces finished to a smoothness of 1-2 micro inches RMS.

HOURS AND MACHINES

IDEAS LIKE THIS CAN INCREASE YOUR PRODUCTION

TIME-SAVING IDEAS

Many Surfaces Handled by Ram Type Lathe in One Chucking

First drilling operation on steam trap while facing from square turret.

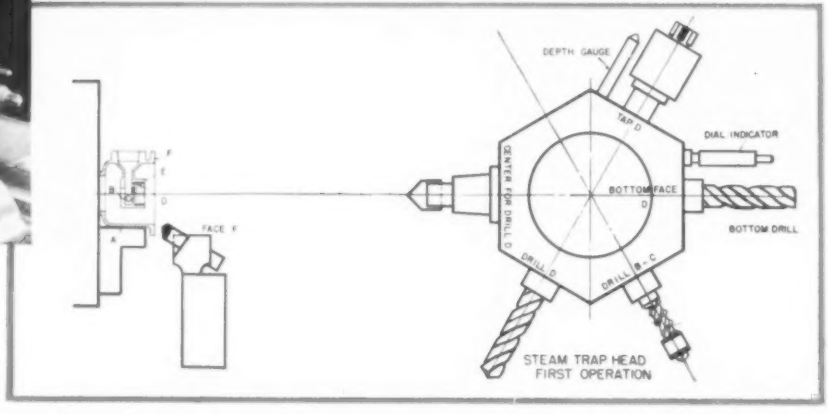
Careful planning shows up on these first operations for a steam trap head. A Gisholt No. 3 Ram Type Turret Lathe was selected for it because of the many surfaces that can be handled in one chucking.

For fast handling, an air-operated chuck is used. These are the operations: drill D, face F, drill B and C, bottom drill D to stop, and tap D while finish facing F. Time is less than 2.5 minutes, floor-to-floor.

To insure concentricity for B and C, the drill is supported with a bushing in D. Note the indicator to hold the depth of the bottom drill for D. This keeps the depth in perfect relation to face F. Interesting, also, is the depth gauge for D, which assures accurate tapping to the bottom of the hole.

When you plan your setup carefully like this around a fast machine like the No. 3 Ram Type Lathe, you're bound to get low-cost, high production every time.

Here, use of air chuck and combination tooling increases speed, while the indicator and depth gauge insure maximum accuracy.



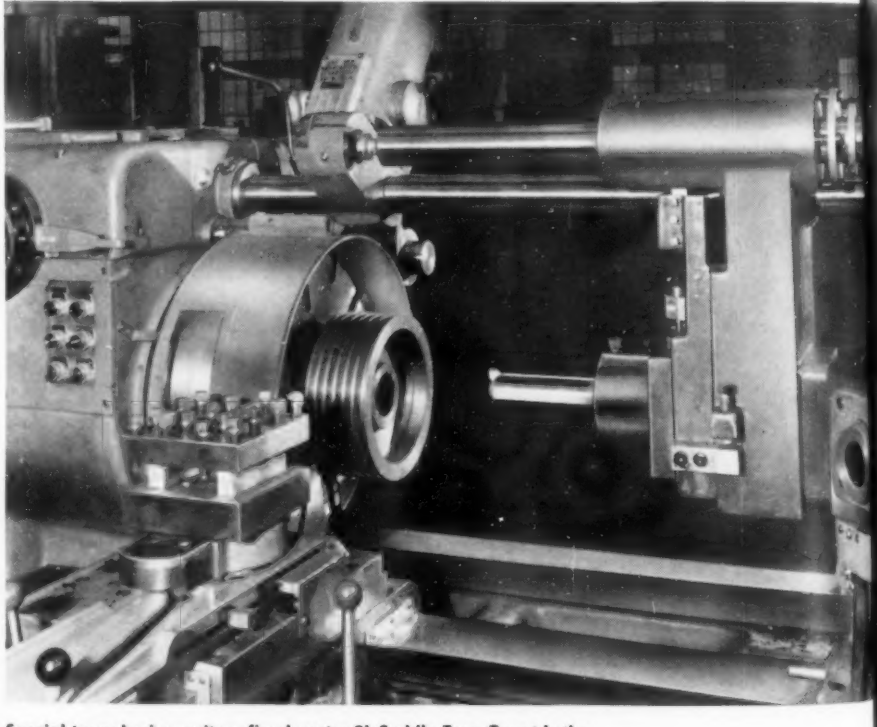
HERE'S HELP FOR SOME OF YOUR TRICKY BORING JOBS . . .

Special Unit on Saddle Type Lathe Handles Reverse Tapers or Special Contours

Here's an idea that can make boring operations easier. It's a special taper boring unit, mounted on a 3L Saddle Type Turret Lathe. In this case, conventional taper boring, it makes use of a stub boring bar, a slide tool and a special overhead pilot bar with milled slot holding a cam plate.

It works this way: As the turret carriage feeds forward, a cam follower on the slide tool rides along the cam plate. This guides the tool slide and boring bar along the angle of the cam plate . . . continuing *past* the cut before stopping. As the turret is retracted, the boring tool is held away from the finished surface to provide tool relief on the return stroke. When the tool is clear, it is automatically recocked for the next piece.

With this special attachment, fast, accurate bores, tapers and contours can be made without tool marks.



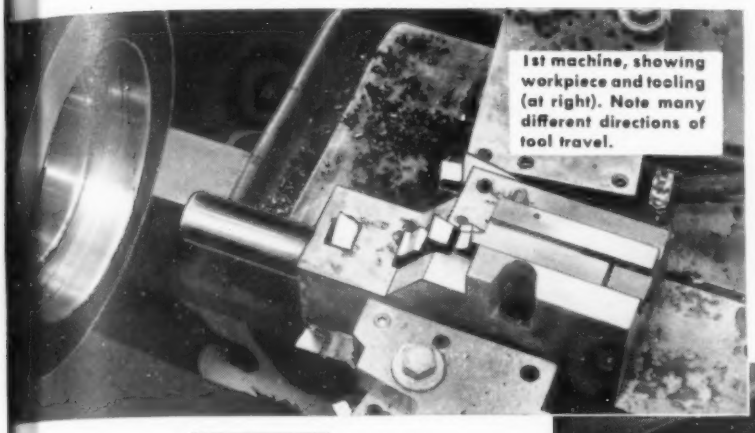
Special taper boring unit on fixed center 3L Saddle Type Turret Lathe

GISHOLT

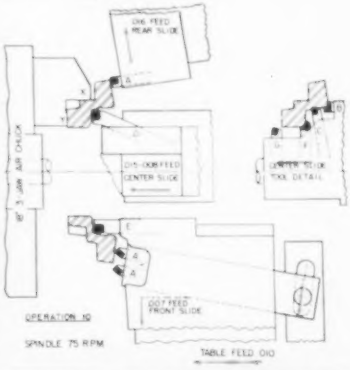
TIME-SAVING IDEAS

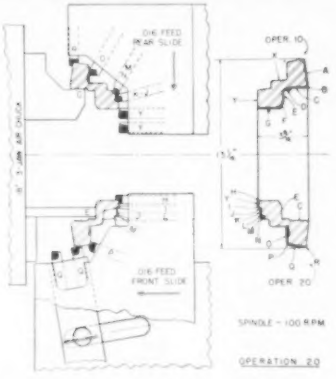
FAST TEAMWORK TO BEAT HIGH COSTS

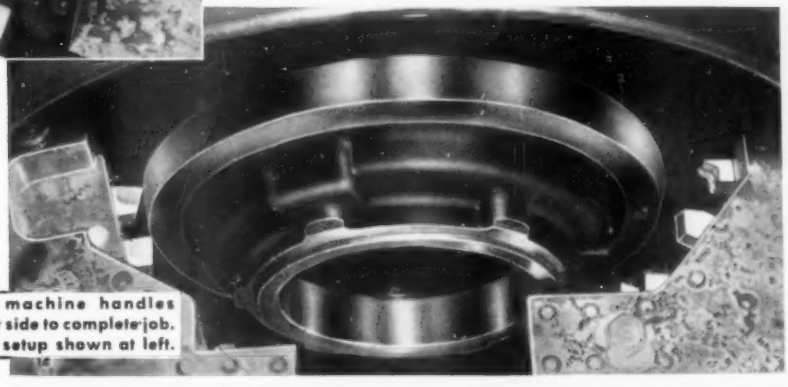
Two Simplimatics and One Man Finish Parts in Jig Time



1st machine, showing workpiece and tooling (at right). Note many different directions of tool travel.







2nd machine handles other side to complete job. Tool setup shown at left.

It's simple ideas like this that frequently pay the biggest dividends.

By pairing up two Simplimatic Automatic Lathes with one operator, these bevel drive gears are produced in quick "one-two" sequence.

The first operation takes 5.0 minutes floor-to-floor. Rough and finish cuts on both straight and angular surfaces are done by front and rear slides while five tools on the center slide handle three diameters and two radii at the same time.

Time is 2.5 minutes floor-to-floor for the second operation. The rear slide faces the end, gear flange, chamfers, and rough turns two shoulder diameters. The front slide, operating longitudinally, finish sizes the two shoulders, corner rounds the bore and carries a sliding tool with cam block for rough and finishing the taper O.D.

Easily tooled to combine both straight and angular work of all kinds—the Simplimatic provides fully automatic operation, enabling one man to tend both machines. It's another example of the adaptability of the standard Simplimatics. New catalog shows many examples. Ask for it.

"TURN-ABOUT" GETS RESULTS WITH AWKWARD PARTS

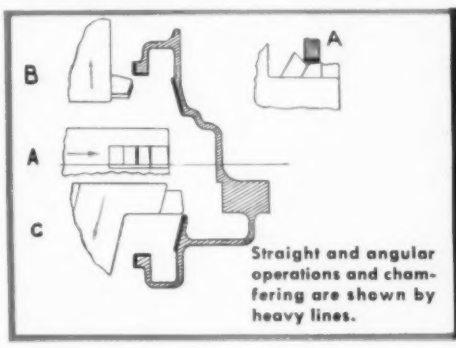
Chuck Holds Tools—The Slide Holds the Work—in this Novel No. 12 Hydraulic Lathe Job

See how good headwork and the No. 12 Hydraulic Automatic Lathe are paying off on this gear case job:

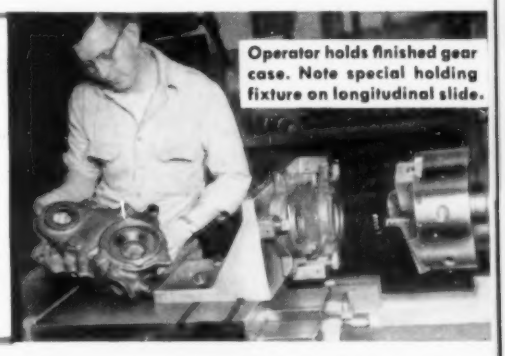
To do the awkward, jumbo-size part the usual way on a conventional turret lathe would have dictated an excessively large machine operating at slow speeds.

However, by turning the job around...and ingeniously mounting the tools on a rotating head and the gear case on a special longitudinal slide, the *work* feeds to the tools. Boring tools, mounted in a stub boring bar, do rough and finish boring and chamfering (A). Forward motion of the work-holding slide then stops and tool (B) faces outside surface. At the same time, tool (C) does angular surface—completing job in a single, automatic operation. Floor-to-floor time is just 1.7 minutes.

No. 12 Hydraulic Lathe with rotating tools (instead of work) shows way to real savings in machining time and costs ...and in machine investment and floor space.



Straight and angular operations and chamfering are shown by heavy lines.



Operator holds finished gear case. Note special holding fixture on longitudinal slide.

GISHOLT

TIME-SAVING IDEAS

HOW TO TURN A HARD JOB INTO AN EASY ONE

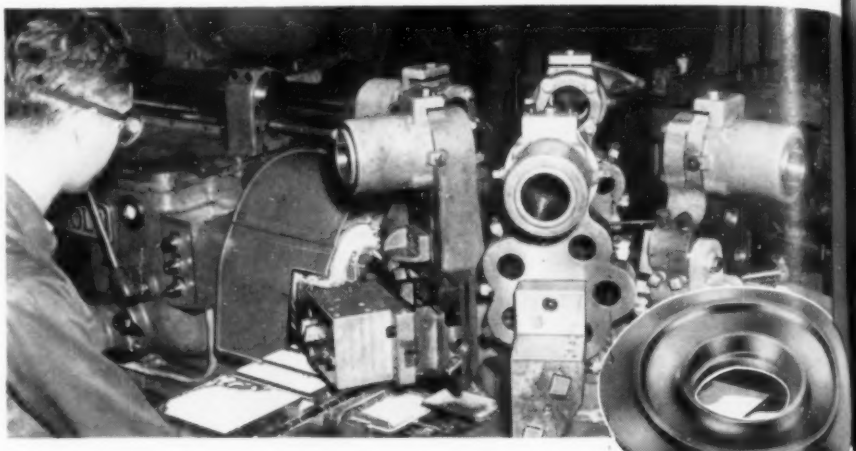
Ten Critical Surfaces Machined by Fastermatic... Automatically

Here's the problem that faced this producer of 7" ball-bearing support rings for our jet program:

The material is difficult—alloy steel forgings of 40-41 Rockwell C. A large number of cuts are required—10 in all. And, close tolerances must be held.

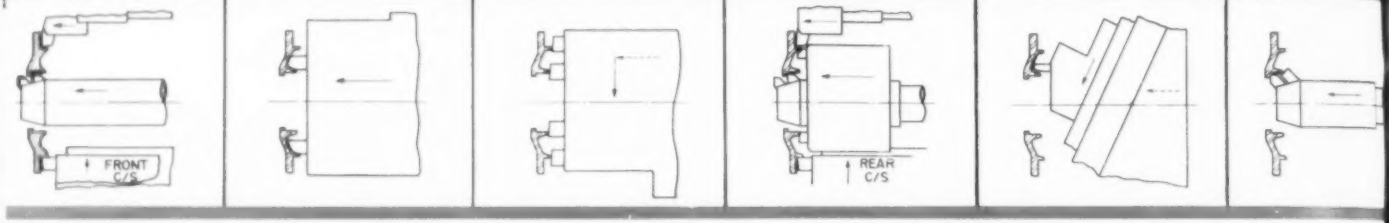
The combination of a 2F Fastermatic Automatic Turret Lathe and excellent tooling did the trick—with the entire job handled in one chucking.

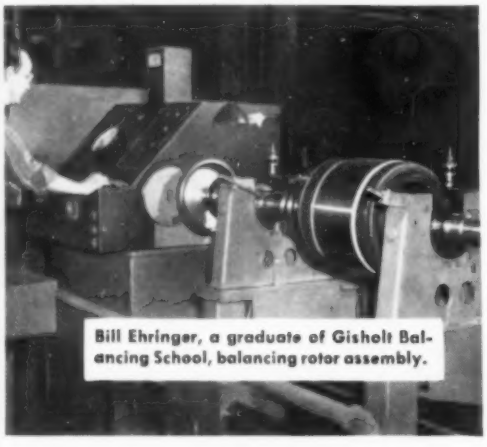
The drawings show how all six stations of the turret are used. Also, the front and rear independent cross slides. All roughing and finishing operations are completed in 4.5 minutes, floor-to-floor.



This Fastermatic performs repetitive machining on 10 surfaces with exacting precision... all in one simplified, automatic operation. All the operator does is load and unload.

Fastermatic setup for machining support rings.





Bill Ehringer, a graduate of Gisholt Balancing School, balancing rotor assembly.

BALANCING ADDS LIFE TO P&H CRANE MOTORS

Better Service Assured by Machine that Locates, Measures Unbalance

Uninterrupted service is a must with users of overhead cranes. "No service" can mean no production.

Harnischfeger Corporation, Milwaukee, leading manufacturer of cranes, goes all out to protect its customers... giving vital electrical components added "life insurance" by precision balancing.

The required correction on this 300 lb. rotor assembly is read directly from the meter on the Gisholt Type U DYNETRIC Balancer. With the amount and location of unbalance determined, a length of solder corresponding to the amount indicated on the machine is metered out and added to the banding wires—while the part is still in the machine.

The results? Increased service life of rotors and armatures, less maintenance, more efficient operation. The Balancer also handles couplings, clutches, fans, etc.

Unbalance in a variety of parts is located, measured and corrected — all without removing parts from machine.

Ask for your copy of "Static and Dynamic Balancing." It has up-to-the-minute facts on balancing.

DYNETRIC BALANCERS GISHOLT

DEVELOPED JOINTLY WITH WESTINGHOUSE ELECTRIC CORPORATION. "DYNETRIC" IS A TRADE MARK REG. U. S. PAT. OFFICE BY WESTINGHOUSE ELECTRIC CORPORATION

No. 5-653
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THE GISHOLT ROUND TABLE represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

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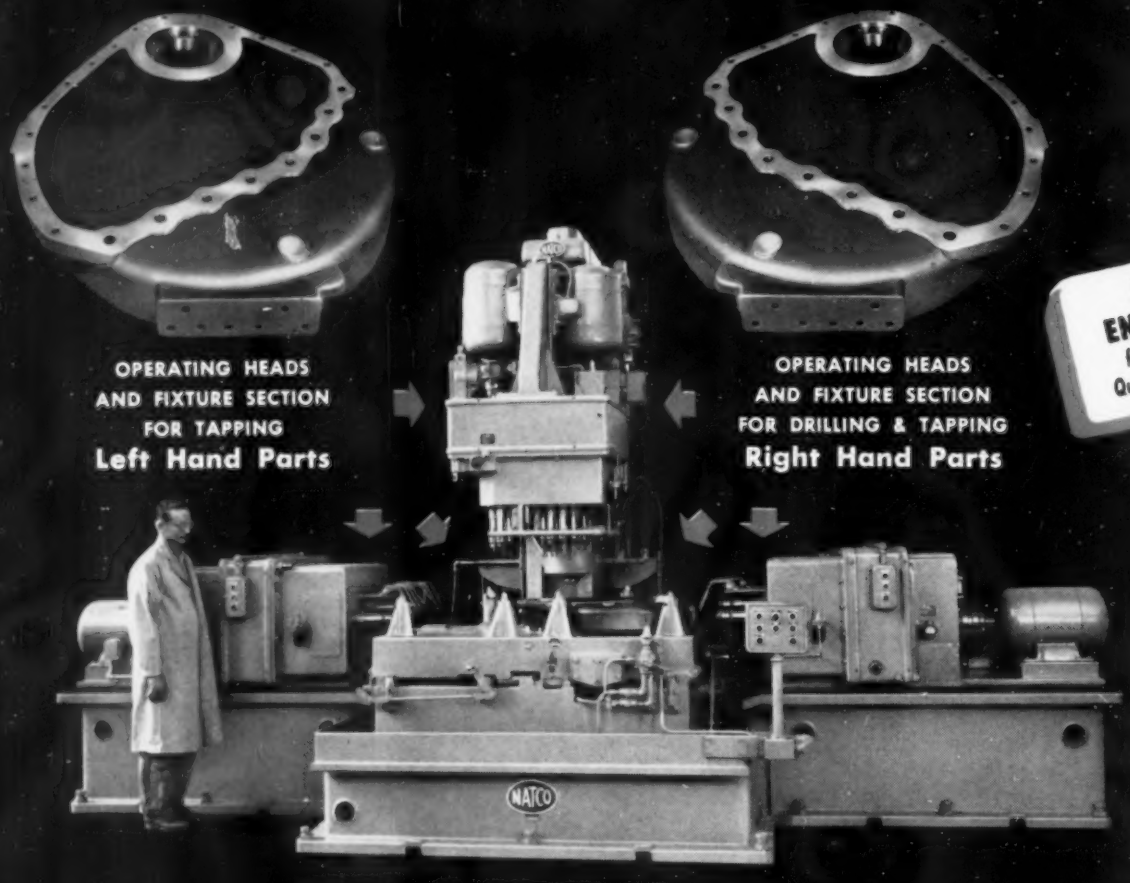
TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

NATCO HOLETAPPER and DRILLER

DRILLS AND TAPS EITHER RIGHT HAND OR LEFT HAND TANK CASES



OPERATION DETAILS

LEFT HAND PART

POSITION 1
Remove and Load

POSITION 3
Vertical Head
Tap 4 Holes
L. H. Horizontal Head
Tap 4 Holes

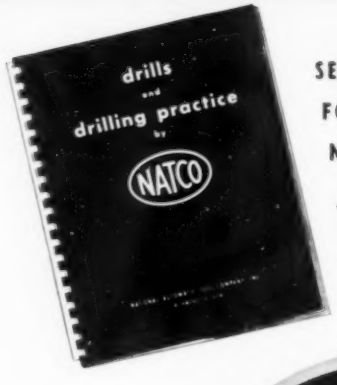
POSITION 2
Vertical Head
Idle
L. H. Horizontal Head
Tap 3 Holes

RIGHT HAND PART

POSITION 1
Remove and Load

POSITION 3
Vertical Head
Drill 8 Holes
R. H. Horizontal Head
Tap 4 Holes

POSITION 2
Vertical Head
Tap 8 Holes
R. H. Horizontal Head
Tap 3 Holes



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*All are Genuine Tool Steels

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- **CUTS WASTE**
- **PRODUCES SUPER WEAR-RESISTANT, NON GALLING TOOLS**

JIC-06 . . . Oil Hardening, Non-Deforming . . . Full Length Kolorkoted Pink and Gray for Permanent Identification

This new combination of Timken® Graphitic Steel features in Hollow Die (Tubular Tool) form is Milne's latest bee-line to better, lower-cost tooling. Has a double advantage over standard oil hardening tool steels.

1. Free graphite makes it the fastest, easiest machining tool steel in tubular form and insures non-seizing properties.
2. Diamond-hard carbide particles guarantee super wear resistance.

Rough turned O.D. and I.D. Saw cut faces. Furnace annealed — no scale. Cut to any length.

Stocks of a range of sizes being built to meet demand. Write for a stock list and Milne's new Hollow Die Catalog section.

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NEW BRITAIN, CONN.	ST. LOUIS	PACIFIC MACHINERY & TOOL STEEL CO. PORTLAND, OREGON		
PHILADELPHIA	BRIDGEPORT			
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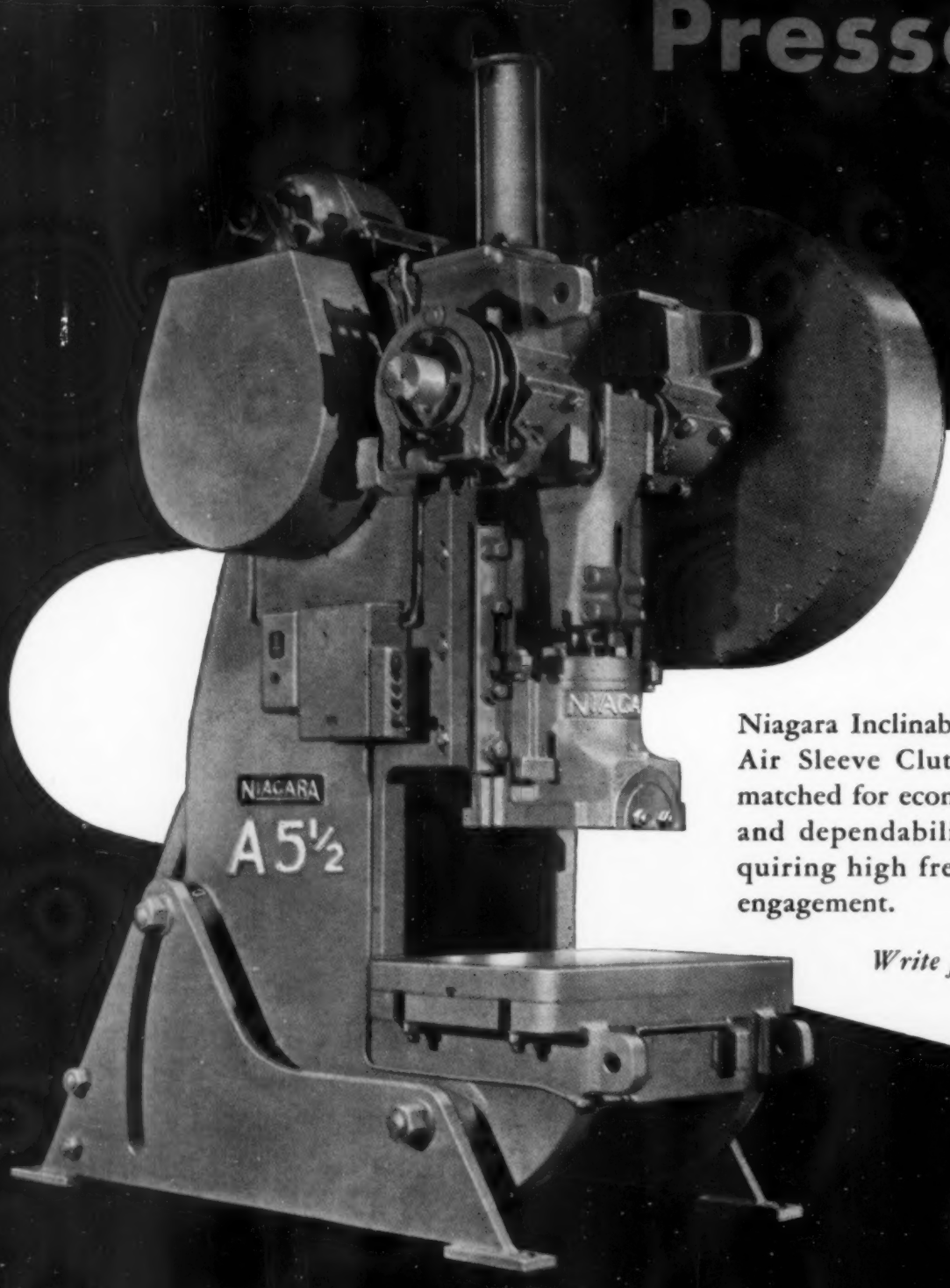
NIAGARA Inclinable Presses



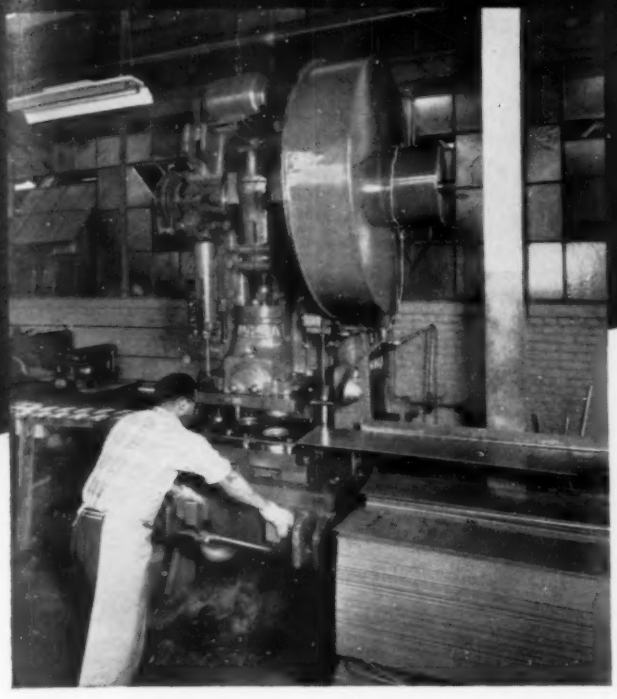
Niagara Inclinable Presses with Air Sleeve Clutch cannot be matched for economy, efficiency and dependability on jobs requiring high frequency clutch engagement.

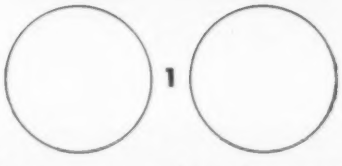
Write for information.

NIAGARA MACHINE & TOOL WORKS • BUFFALO 11, N. Y.

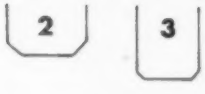
On the Production Line

AT SHWAYDER BROTHERS, INC., DETROIT

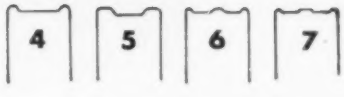




1. Punching two round blanks per stroke on Niagara A-5½ Press with Air Sleeve Clutch.

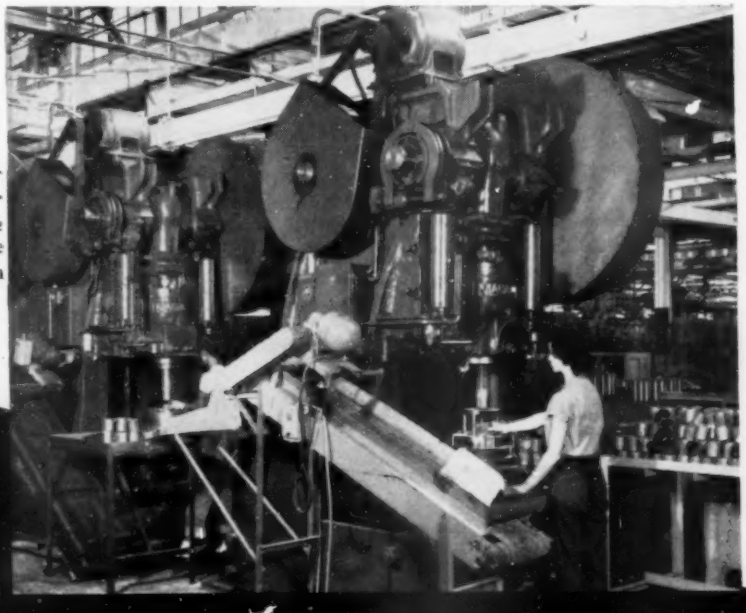


2, 3. Cupping and Redrawing on A-5½ Presses with Air Sleeve Clutches.



4, 5, 6, 7. Indenting end on A-3½ Presses.

8, 9. Forming hexagonal shape and Ironing side wall on A-5½ Presses with Air Sleeve Clutches and with Niagara Cushions.



The final piercing and tapering operations are done on A-3½ Presses (not shown.)

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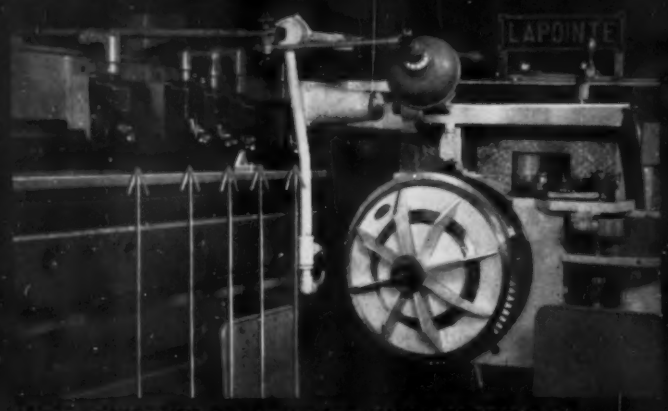
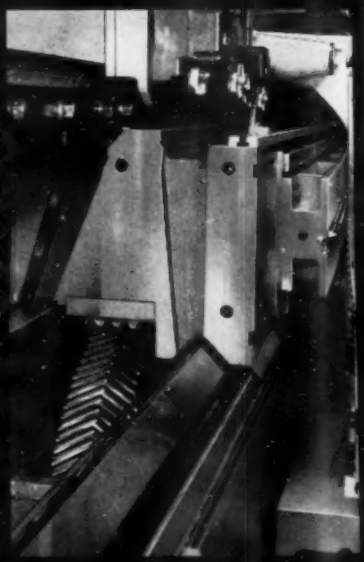
LAPOINTE offers



LIMIT SWITCHES for operating DUAL SPEED and DUAL CYCLE (Patented*)

The Dual Speed feature permits the machine to be operated at two predetermined speeds for the same broaching stroke. Dual Cycle is the exclusive LAPOINTE feature that has been developed for successful broaching of jet engine components without requiring tool changeovers for the accuracy required.

Two of the reasons for the smooth, positive functioning of this new LAPOINTE Broaching Machine are seen in this picture showing the large diameter continuous-tooth herringbone gear and rack, and the guiding of the massive main slide.



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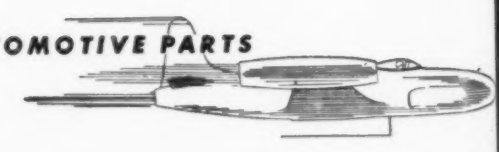
FASTER BROACHING OF JET ENGINE PARTS AND AUTOMOTIVE PARTS



Dealers in principal U. S. cities and major foreign countries

LAPOINTE 30/180" SRHE, broaching Turbine Wheel J57.

The electro-mechanical drive accounts for the remarkable versatility and flexibility of this newly developed single ram horizontal broaching machine. Note that the cutters are *at eye level.*

new *ELECTRO-MECHANICAL DRIVE* horizontal BROACHING MACHINE

for SURFACE BROACHING at speeds up to 300 fpm!

Now, for the first time, there is practically unlimited opportunity to make tests to determine the best broaching speed for any particular metal! Once the proper speed is found, this new LAPOINTE Broaching Machine will give

- **substantially increased production**
- **better finish and**
- **greater accuracy through freer cutting action.**

Carbide-tooth broaches and HSS broaches both perform exceptionally well on this machine, which is fully described in a new bulletin available on request. Ask for *Bulletin SRHE-5.*

Another striking example of Lapointe engineering leadership, with everything designed and built at one source . . . no divided responsibility!

Industry looks to Lapointe for the latest developments in broaching machines, tools, and fixtures.

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THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

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CLASS III THREADS with REPETITIVE ACCURACY!

J & L Automatic Opening Die Heads are sold with this guarantee: that your threads will be held consistently within the exacting Class III tolerances for form, lead and pitch diameter, throughout the long life of the J & L chasers.

FOR BROWN & SHARPE AUTOMATICS and SMALL TURRET LATHES
Capacities from #0 to 1¼"

RADIAL CHASER TYPE
Capacities from #8 to 4¼"

TANGENT CHASER TYPES
Stationary and Revolving. Capacities from #4 to 2"

Some of the reasons why:

COMPACT, RUGGED DESIGN GIVES MAXIMUM SUPPORT TO THE CHASERS. J & L Dies are made of solid steel, no built-up sections, hardened and precision ground throughout. Chasers are supported at the point of, and in the direction of, maximum strain.

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Bristol Hex Socket Cap Screws give a new kind of socket screw performance. Used in products ranging from electric razors to massive machine tools, these modern fasteners have proved themselves with design, production and maintenance men everywhere. Here's why:

Made of special alloy steel, and specially treated to develop the proper hardness and strength, Bristol Hex Socket Cap Screws will give long service under the most severe conditions.

Bristol's Hex Socket Cap Screws set faster and easier, speeding up assembly on the production line. And they do away with protruding screw heads, giving smooth, flush surfaces for safety and streamlined appearance.

There's no delivery problem with Bristol's Hex Socket Cap Screws, either. Adequate stock is on hand to fill all orders without delay. In sizes ranging from No. 0 wire to 1 inch, all of Bristol's screws are precision-made to conform to Class 3 fit.

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YOUR NORTON DISTRIBUTOR can supply you promptly with ALUNDUM wheels in the new G Bond. Ask him about arranging a try-out in your plant. Or write to NORTON COMPANY, Worcester 6, Mass. Distributors in all principal cities. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Mass.

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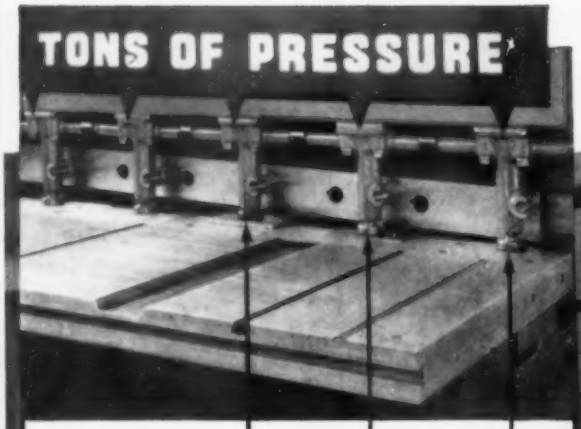

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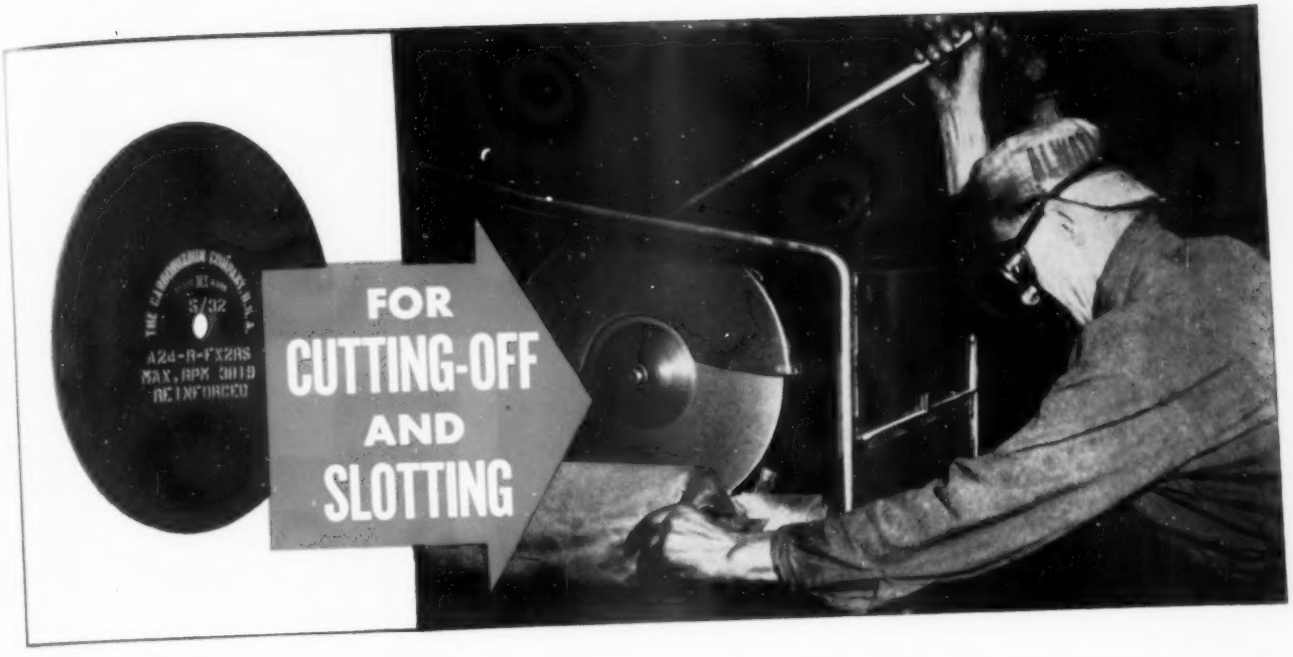

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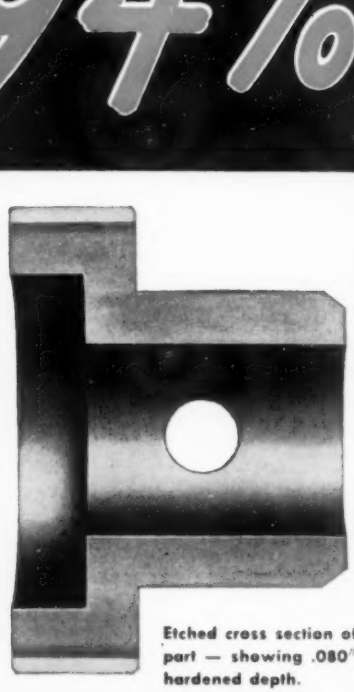

Etched cross section of part — showing .080" hardened depth.

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The Tool Engineer

Our Moral Responsibility

"The tool engineer's function is to provide the most *ingenious*, the most *efficient* and the most *economical* tools, for *wise use* in providing *quality* and *quantity* goods for the *maximum benefit* of mankind."

This is a direct quotation from an address at the Purdue On-Campus Tool Conference at Layfayette, Indiana, April 18, 1953. The words are those of Frank C. Hockema, Executive Dean and Purdue University Vice President.

That sentence is a complete philosophy of life for a manufacturing man. Creativeness is recognized as the single most important element of a thinking man's makeup—creativeness, ingenuity, inventiveness—all are synonymous, all are necessary to produce better goods at lowest cost.

Tools (processes) must always result in efficient and economical manufacture. The end-product must first be of sufficient quality for its planned use; the quantity, although secondary, is absolutely essential in a competitive economy.

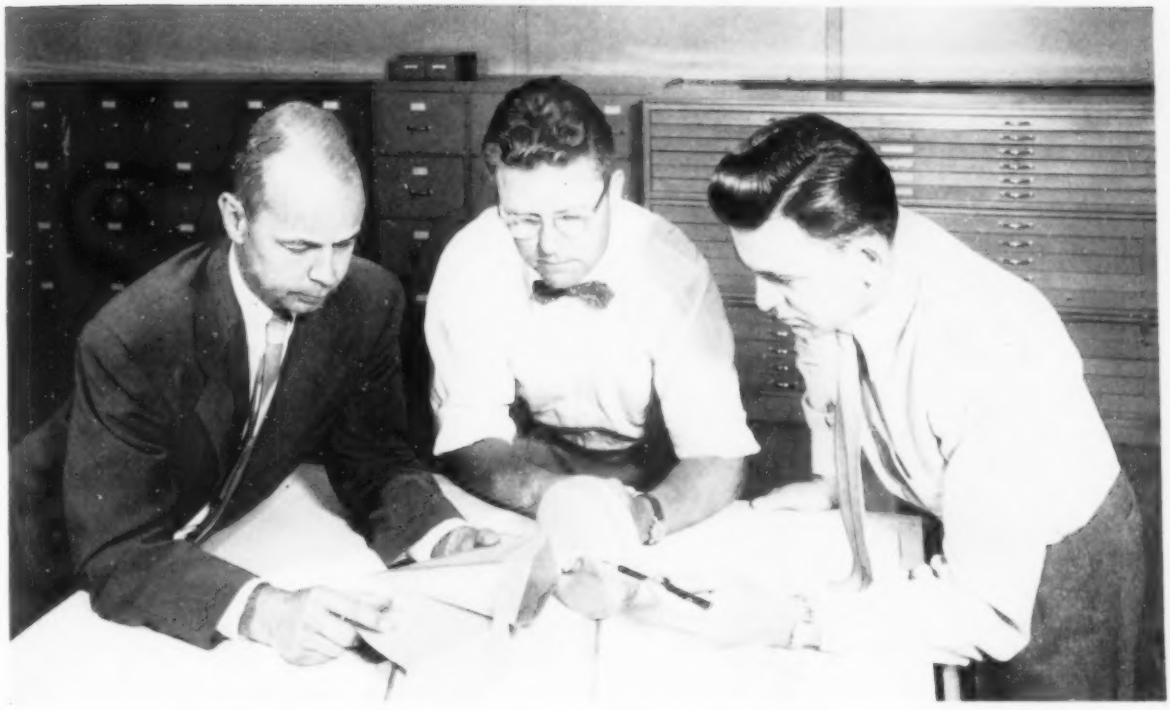
And now the underlying morality of our technical existence is brought out by Dean Hockema's statement "for wise use—for the maximum benefit of mankind."

Tool engineering is the basis of high productivity; high productivity is the hallmark of the material prosperity of America. While perfecting ourselves as tool engineers for our greater material good, always remember our moral responsibility

. . . for the maximum benefit of mankind

R. F. Waindle

PRESIDENT
1953-1954



The young engineer has frequent contacts with members of top management.

TRAINING ENGINEERS

By Kenneth A. Meade
Director of Educational Relations
General Motors Corp.
Detroit, Mich.

FACED WITH A SHORTAGE of 95 thousand engineers, industry must utilize available engineering talent to the fullest. Also the potentialities of the young engineer should be developed as quickly as possible, since industry cannot afford to wait for him to slowly mature to full professional status through years of experience. While college training furnishes the broad general base for professional careers, educators can hardly provide for specific requirements in the many specialized branches of engineering. These, then, are some of the important reasons for training programs in industry.

Considerable emphasis is given by each operating division at General Motors to the development of programs aimed at helping the graduate bridge the gap between closely supervised development in school and self-development as an employee. It is recognized that the young graduates enter industry with a good fundamental understanding of theory and some background in its application.

In a sense, they are the partially processed personnel material out of which will come many of the ranking engineers and executives of the future. Thus, it is the company's responsibility to establish procedures which will assist the graduate in his introduction to industrial employment and, at the same time, maintain for him an environment which will stimulate and promote his growth. Provided with these helps, it is still required of the individual employee that he take the initiative in self-development through use of the opportunities that are presented to him.

From a talk presented at the ASTE Leadership Conference, Detroit, March 16 and 17, 1953.

These Junior engineers are acquiring a brief shop background to aid them later in tooling and production problems.

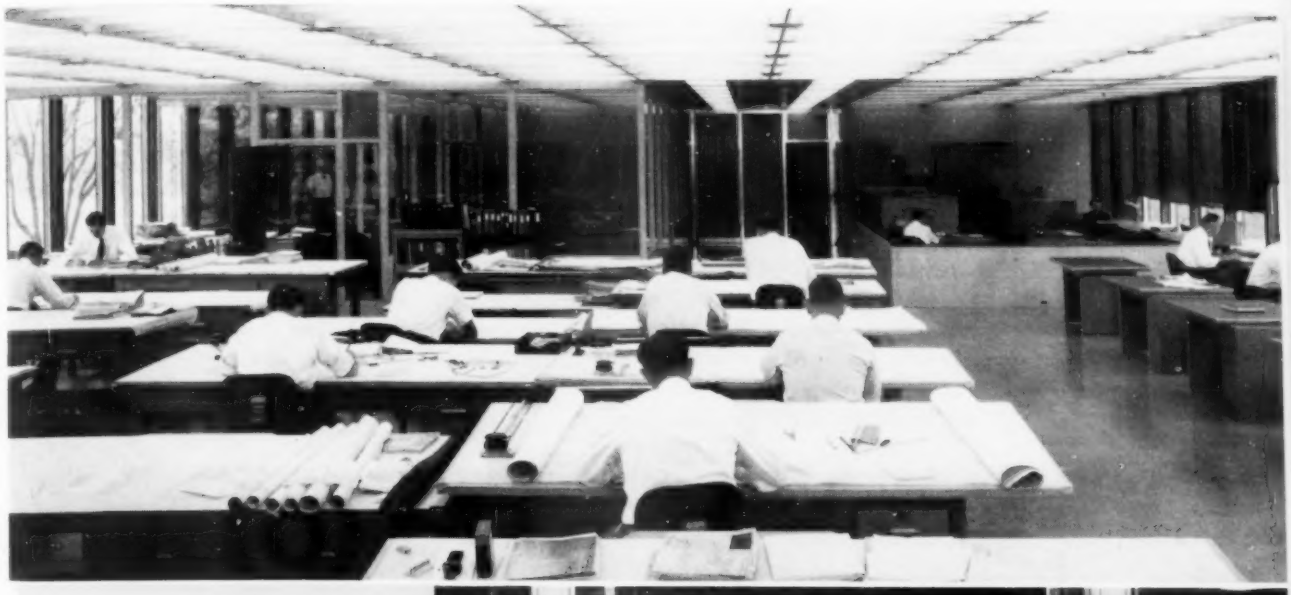
In meeting the requirements outlined, the majority of operating divisions have set up orientation training programs for their college graduates.

These programs usually consist of a series of practical work assignments in the departments or sections of the division related to the field of work for which the graduate was employed. For example, a junior engineer might be given brief assignments for observation in manufacturing, production engineering, accounting, sales, traffic and purchasing in addition to his major work assignments in tool design or product development. This gives him a limited amount of information about the business, but primarily helps him understand the interrelation of engineering activities with other operations in the organization. It is also helpful to both employee and management in proper placement of the new man in his first post-training work assignment.

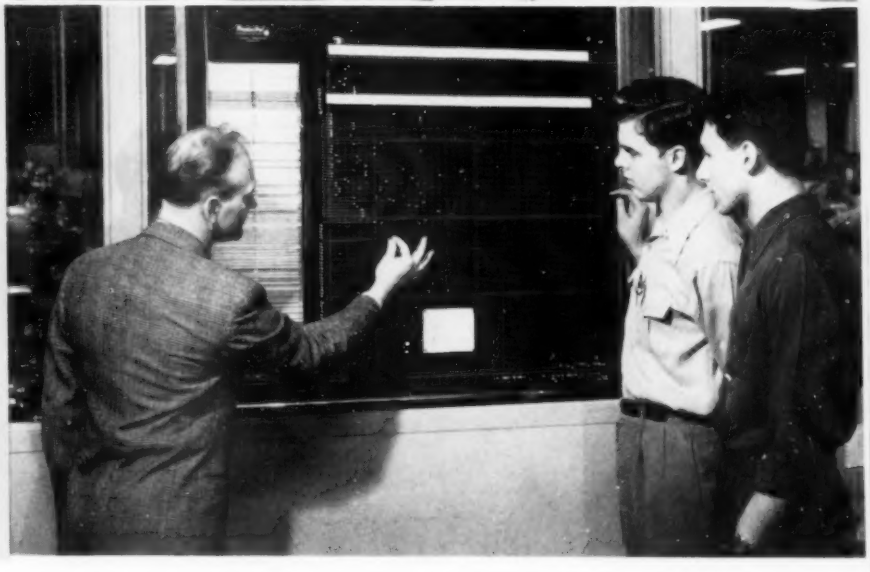
An essential element of all in-plant training programs is frequent contact between executives of the management group and the trainees, as this provides the opportunity for each young engineer to acquire some of the practical knowledge that these older men have accumulated during their years of employment. Even more important—it helps him to know that his efforts are being recognized; that his capabilities are being evaluated; and that his professional code is being improved by these contacts. He is impressed with the fact that his educational opportunities did not end when he received his diploma or degree. He is urged to participate in local technical societies, in community affairs, and in plant activities of various kinds within his interests, always with the objective of his personal and professional development through the medium of his own activities.

In discussing the technical phases of this development program for young graduates it must be acknowledged that any orientation program aimed only at job competence would be inadequate. "Human engineering" factors are also a part of the same program and this phase reveals some of the psychology of the company in dealing with its employees.

Any large corporation is an organization of many people in which no single individual is apt to reach his personal objective without the voluntary cooperation and assistance of his associates. Experience has demonstrated many times that the degree of cooperation is determined by the personality factor more than anything else. Modern industrial progress depends on teamwork to such a degree that the graduate must be able to submerge his individuality to a considerable extent in order to become an effective member of that team. He must be capable of making his own contributions, yet be



Some trainees are assigned to drafting, production engineering, accounting and other activities according to their chosen fields.



Two young engineers learn about scheduling from a veteran.

flexible enough to change his own ideas as new thoughts are presented to him by other members of the groups. Few indeed are the industrial positions wherein an employee can work as a "lone wolf." If he honestly wishes to progress, he must be able to adapt himself to the organization in a wholehearted manner. He must learn to work with people until his responsibilities increase to such an extent that he in turn can inspire people to work with him.

Much of the executive effort going into the development program aims at the goal of influencing and correcting personality and professional characteristics which, if left unchecked, would have an adverse influence on the individual's future progress in the organization. This is a difficult task, but the results justify a great deal of effort.

Considering these essential components of a successful career, human engineering attempts to assist in the development of each of the components as far as possible. Limitations are recognized in seeking improvement in native abilities and in utilizing existing qualities to their best advantage. Above-average physical and mental characteristics in combination with professional ability are valued highly. In fact, every effort is made to determine in advance that new employees have an abundance of native ability.

Few unsuccessful employees fail to progress, however, because of insufficient technical ability or skill. Many have been found lacking in personality development or personal characteristics and their lack of progress is classed as a professional failure. The price of these failures is large at any time, but it grows greater when the man is allowed to move along in the organization for some time before his shortcomings are evident. An effort is made to avoid such mistakes throughout the development program by frequent appraisal of each individual in the program, by expert counseling aimed at correction, and by continuous association with men of

experience and well rounded personality.

These are some of the things believed important in providing for self-development of the employee. This concept of an individual developing himself as opposed to being developed by the company recognizes that no one is foreordained to become an executive although the program strives to achieve that result over a period of years.

One of the fundamental responsibilities of the school from the elementary through the college level is to give the student training and drill in the use of the essential tools which he will use in life. In addition, throughout his formal educational program he should be given a thorough grounding in the history of our government, the working of our political system, and an understanding of our competitive industrial system and the basic economic laws, so he can assume his responsibilities as an American citizen and discharge them intelligently.

It is important that the student be helped to analyze himself to find out what he can do best; what his interests and ambitions are, and, what his human relations capabilities are. Wise counseling, aimed at getting the student to a point where he can choose his occupation and career wisely, preparing him to periodically appraise himself as he develops during the remainder of his working life, is an essential part of his basic education.

Since much of what the student learns in school and later on the job as an employee, and in his everyday pursuits as a citizen, are learned from observation of the way other people do things, he should be trained as early as possible how to observe and how to evaluate what he observes. Indeed, most people in business and industry, who are in supervisory or other management responsibilities, could trace the methods they use in leading the people who work for them to the observations they made of the way they were led by their teachers while in school, and their first bosses when they went to work. Unfortunately, many educators and bosses overlook this opportunity of furnishing the example and stimulus that students and new employees can apply later.

From this discussion it may be concluded that the engineering profession is becoming increasingly complex. This fact is illustrated by a recent description of the modern engineer as ". . . . the intellectual amalgamation of a combined physicist and chemist who is professionally conscious of the value of a dollar, a mathematician who is willing to arrive at numerical results, a draftsman who prefers to sketch in freehand style, a team worker who has in mind his own but can be convinced that there is value in the views of his confederates, and a reporter who can write in a clear, brief style. In addition, he will be more useful in his profession if he is an unhesitating public speaker."

While it is indeed rare to find an individual who in himself fulfills such diverse specifications, the definition does point out the need in engineers for all around personality development.

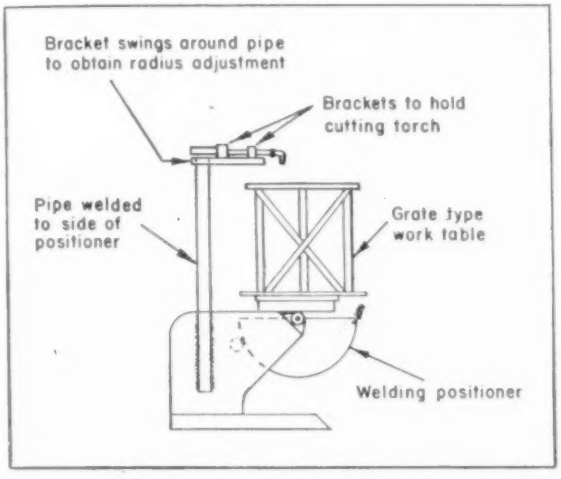
Typical training classroom for college graduates.

Gadgets

Ingenious Devices And Ideas To Help The Tool Engineer In His Daily Work

Welding Fixture

The problem, for which the solution is pictured here, occurred in a plant engaged in defense work in addition to production of implement parts. The defense job required considerable cutting torch



work. Diameters of parts ranged from two inches up to 45 inches, which created production snags.

A special cutting machine was out of the question because of excessive cost, uncertain delivery and the difficulty of justifying the purchase against production requirements. Redesign was ruled out by the nature of the contract.

To solve the problem a pipe support was fastened to a 200-pound capacity Worthington welding positioner. A grate-type work table of 24-inch diameter was fabricated. The work table was fastened to the welding positioner. A torch support was fastened to the upright pipe. The torch support has clamps on it for positioning and holding the cutting torch.

The device is both simple and successful. The welding positioner provides the rotary motion. It can be tilted for burning tapered holes. The rig has been used for holes from ½ inch to 30 inches in diameter.

In operation the workpiece is laid out and the center marked. A bent pointer is clamped in the torch support and the work moved into position. Then the torch is clamped into place and the work cut to specified diameters. Total cost was $25 plus one idle welding positioner.

Norman A. Benson
Senior Member ASTE
Santa Clara Chapter

Burring Attachment

A special screw attachment used on Thompson rolls at TEMCO Aircraft Corp., Dallas, Texas to set the space between the rollers makes it possible to roll burr flat skin sections without danger of warping. The result is a considerable saving in time.

Before the attachment was developed, it was found that when enough pressure was applied to the rollers to prevent riding over large burrs, parts were frequently warped. Hand burring, however, was a time consuming operation.

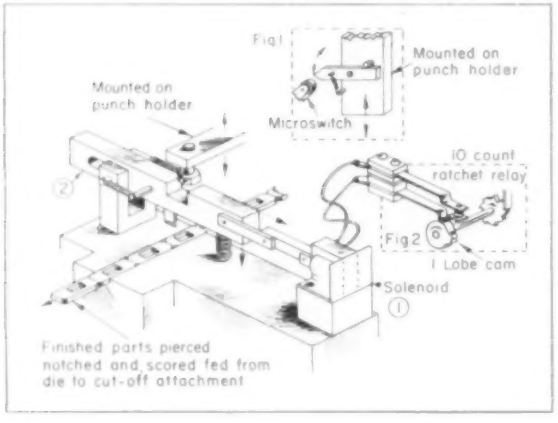
The device consists of two angle iron brackets, one of which is mounted on each end of the machine's upper roller. Each bracket has a nut welded to its top, through which a machine screw is threaded upward until it contacts the hydraulic cylinder which maintains pressure on the rollers. By adjusting the screws, the upward travel of the top roller is limited to the exact thickness of the part to be rolled, making it unnecessary to maintain excessive hydraulic pressure to prevent the roller's riding over large burrs.

Once the device has been adjusted, any number of parts having the same thickness can be rolled without change of setting.

M. H. Guy
Dallas, Texas

Cutoff Attachment

The use of this cutoff attachment allows any desired number of finished pieces, previously pierced, notched and scored in a progressive die and joined to each other, to be ejected from the die before being separated from the strip stock.

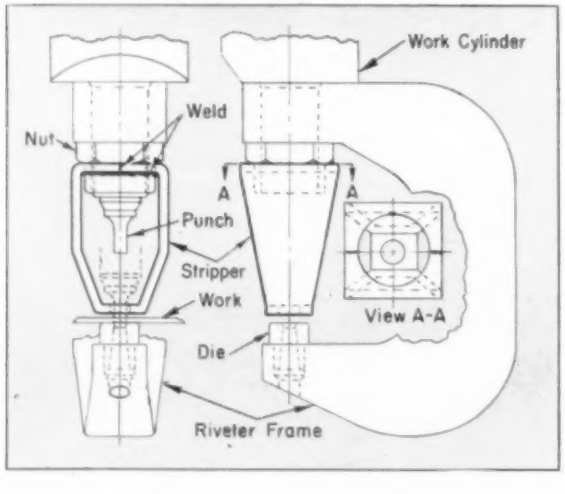


In this application it was desired to produce a ten-piece strip, and therefore a ten-step ratchet was used. The upstroke of the punch holder trips a limit switch by means of a flipper device as shown. The coil of the relay is thus energized, revolving the ratchet one space. On the upstroke, the cam has moved around, closing the circuit and energizing solenoid No. 1, which withdraws the cutter blade bar, 2. As the punch holder descends, it will strike the cutter blade bar, severing the ten-piece strip and allowing it to drop free.

Frederick Barker
Ilion, N. Y.

Stripper for Hydraulic Punch

Portable hydraulic riveters are sometimes converted to punching metal, in which case the movable and anvil dies are respectively replaced by a punch and piercing die. The problem is to strip the pierced stock from the punch, and one of the methods used is to install the stripper between the work cylinder retaining nut and the neck of the riveter frame.



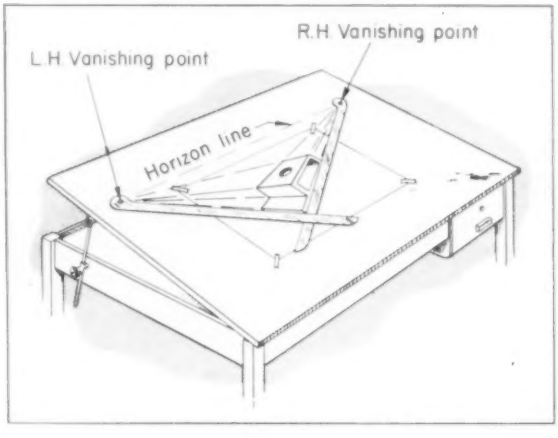
This method has the disadvantage that the nut must be shortened, leaving fewer threads to take the strain of punching pressure. Consequently, the threads may be stripped. Another disadvantage is that unless the ID of the stripper be disproportionately large, there will be insufficient wrench clearance, preventing proper tightening of the nut.

The simple method shown here obviates these disadvantages. The nut is turned on its lower end, leaving a shoulder and also sufficient length for wrench grip. A stripper is made to approximate shape and proportions shown, the upper bends being joined by welding.

This end is then bored out to fit the turned diameter on the nut, and the lower end drilled for clearance around the punch. Tighten the nut, slip on the stripper, rotate it to face front, or side if prefered, and weld to the nut with sufficient bead to resist the stripping force. The stripper shown is proportioned to a 17½-ton portable riveter frame.

Andrew E. Rylander
Senior Member ASTE
Golden Gate Chapter

Perspective Straight Edge



To provide a simple means of making a clean-cut perspective sketch, the straight edges shown here are easy to make and allow fast rendering of ideas. The important consideration is that the straight edge be straight and have the thumbtack hole on its locus.

Materials can be 0.062-inch aluminum, T6 temper and anodized; 3/32-inch plexiglass with beveled working edge; 1/16-inch mahogany aircraft plywood or substitute. Lengths will be determined by the size of the working surface. It must be remembered that the edge must reach the most distant diagonal corner.

John L. Turner
Mineola, N. Y.

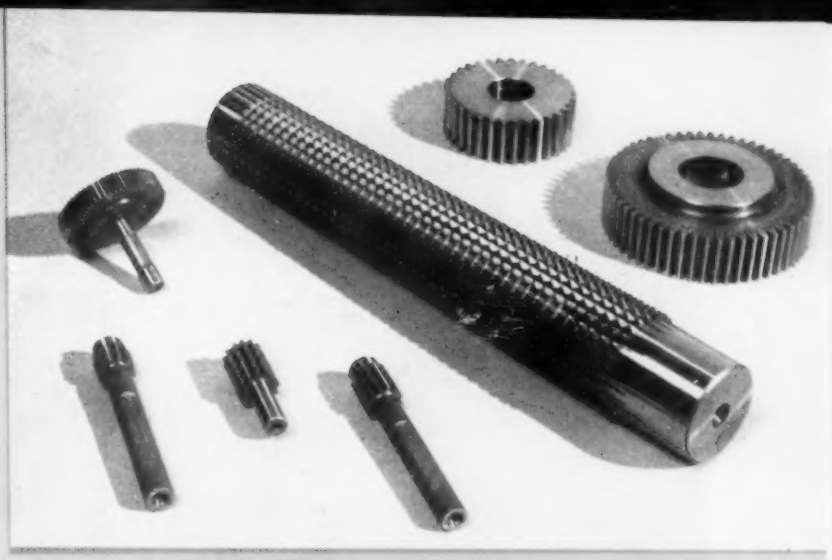


Fig. 1. Master gears, gages and broach having involute forms produced by circular arc method.

Splines and Gears

determining allowable involute approximations

By J. Silvagi*
Tool Engineer Dale Corp., Detroit, Mich.

IN GRINDING INVOLUTE splines, gears and broaches the formed wheel has won favor over the generating method. The shape of the tooth space of the work is diamond-dressed onto the wheel so that rough and finish passes of the wheel on the work finish the teeth to size.

Fixtures to dress the involute form onto the wheel vary in complexity from elaborate sine bar and beam-type true involute dressers to the simple circular arc dressers which approximate an involute. The template and pantograph type of dresser used in many shops is excellent for high-production jobs but would be too slow and costly for short-run items. This article will deal with the circular arc method which is employed to produce parts such as those illustrated in *Fig.* 1.

The advantages of the circular arc dresser over other types are its compactness, minimum of moving parts, quick setup, and smooth, vibrationless dressing of the wheel. It may be used for both internal and external form grinding.

By pivoting in a hole or in a V-notch, a diamond held by a suitable holder, *Figs.* 2 and 3, is swung in a circular arc to approximate a short portion of the true involute curve. For gears and splines with stub teeth or with a large number of teeth, the approximation can be within 0.0001 inch. This is sufficiently accurate for gages and broaches. Involute spline shafts and fittings have allowable profile errors from 0.0003 to over 0.001 inch, depending on size of tooth and quality of required fit. For these applications, the circular arc does an admirable job.

The circular arc approximation of the involute involves the selection of a suitable radius at the proper distances from the wheel center line and the work axis. If the radius of curvature at the pitch diameter is chosen as the dressing radius with the pivot located at the base circle tangency, an arc struck will overshoot the dedendum of the tooth and cut into the addendum of the tooth as shown in *Fig.* 4. By retaining the same value for the radius and shifting the pivot point away from the base circle, a better approximation is obtained. For many standard stub splines this is sufficiently accurate. *Fig.* 5 shows the simple equations required when the pivot point is on the base circle.

Gears and splines of special design need a more careful analysis. The selected dressing radius can become larger or smaller than the radius of curvature corresponding to the pitch diameter. Often, the involute profile of a tooth cannot be approximated close enough with any circular arc and to recognize this fact may save hours of calculation or the building of inadequate tooling.

Various mathematical and drawing table methods are used to determine the error at a given point on

* Senior member ASTE, Detroit chapter.

—photo, courtesy Vinco Corp.

Fig. 2. Diamond dresser for forming grinding wheel by circular arc method.

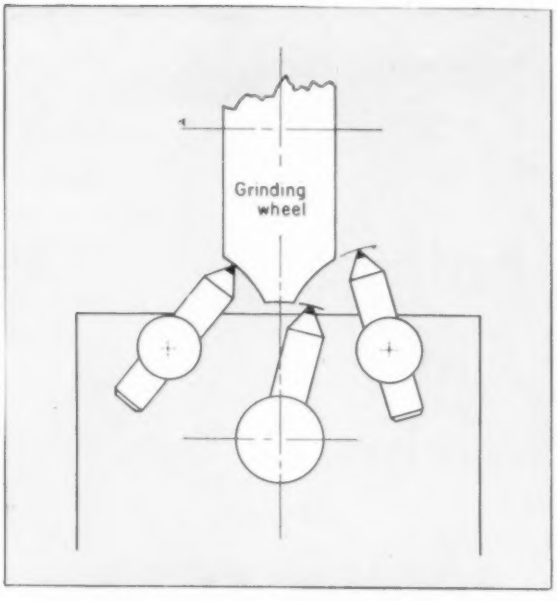


Fig. 3. Positions of diamond points for dressing grinding wheel.

the tooth but the following chart method reduces the required calculations to minutes instead of hours. The charts are based on the "law of similarity" which defines all involutes as photographic enlargements or reductions of a single unit involute.[1]

The charts in TABLES 1, 2 and 3 are arranged in groups of unit dressing radii. R_u, at different locations, K_u from the center of the base circle. The entering columns on the left are ev Θ and ε which locate a definite point on the gear or spline profile. Values ev Θ and ε are shown graphically in *Fig.* 6.

The body of the charts is a tabulation of the deviations of the selected radius from true unit involute. If the radius cuts into the involute area the deviation is listed as negative. If the radius swings outside the involute area it is listed as positive. Under certain conditions, a circular arc may cross and recross the involute curve. The maximum number of crossings in the ordinary tooth range is three times.

The shaded areas of the chart represent the zones of least deviation. Multiplying the values by the base radius of the gear will give true deviation in inches.

Determining Radius and Pivot Position: Use of these charts requires only the following four steps:

FIRST: Establish the required range of the tooth profile. It extends from the outside or major diameter of a gear or spline to the true form diameter near the root. Internal gears and splines range from the minor diameter to the true involute form diameter. Divide the two given diameters by the base diameter to obtain ev Θ values for each.

SECOND: Using the charts, locate the limits of the tooth form in the ev Θ column. Move horizontally

[1] *Involutometry and Trigonometry* — Dr. W. F. Vogel, Michigan Tool Co., Detroit, Mich., p. 302.

Fig. 4. Circular arc swung from base circle cuts into the addendum and overshoots at tooth root.

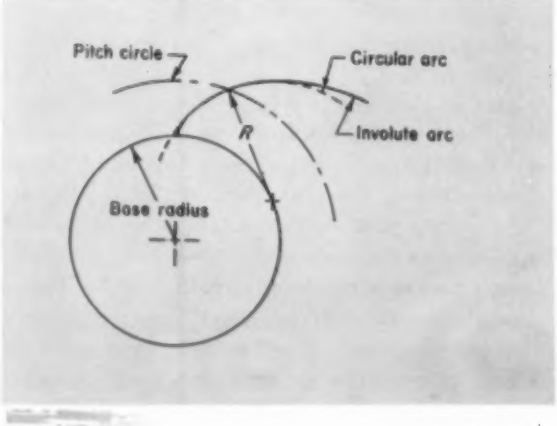
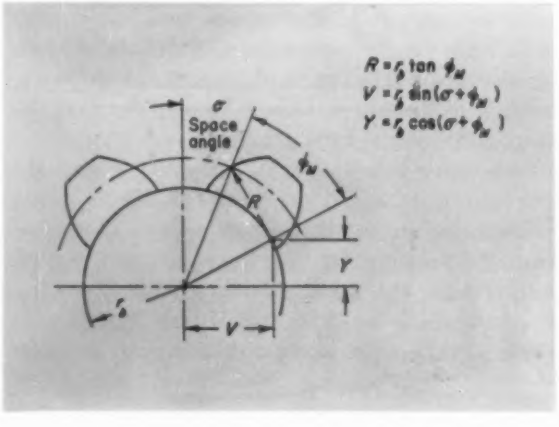


Fig. 5. Rough involute approximation with pivot on base circle.



across the chart and select the column which has the least deviations.

THIRD: At the top of the selected column are the values of R_u and K_u. These are multiplied by the base radius to obtain the actual dressing radius and its pivot distance from the axis. Their symbols are R and K.

FOURTH: To find the horizontal distance V and the vertical coordinate Y, solve the oblique triangle as shown in *Fig.* 7. Distance F. is the given distance from the axis to the center of a measuring pin located in the tooth space. Radius r_{pin} is half the pin diameter. Then:

$$\frac{K^2 + F^2 - (R + r_{pin})^2}{2F} = Y$$

$$\sqrt{K^2 - Y^2} = V$$

Example 1: Using the foregoing four steps, find the best dressing radius and its coordinates for a gear with the following data:

30 teeth, 20 diametral pitch, 20 degree pressure angle.

1.4095 = Base diameter
1.6500 = Outside diameter
1.4500 = True involute form diameter
1.6958 = measurement over two 0.0960 dia. pins.

FIRST: Obtain ev θ values as follows:

$$\frac{1.6500}{1.4095} = 1.171 = \text{ev } \theta \text{ at the outside diameter}$$

$$\frac{1.4500}{1.4095} = 1.029 = \text{ev } \theta \text{ at the TIF diameter}$$

In terms of degrees of roll from the base circle (ε), the profile limits are 14 degrees to 35 degrees from the base circle origin. Actual degrees of roll are 21.

SECOND: Enter the ev θ column of the chart and set the upper and lower limits of the profile in terms of the unit involute. Traversing across the tables, it appears that the best unit radius is 0.4167 with a K_u value of 1.0050. The maximum profile error would be r_b times the greatest table deviation or 0.7048 (0.0005) = 0.00035 inch. This is sufficiently accurate for the part gear.

THIRD: The actual radius and pivot locations are:

$$0.7048 \ (\ 0.4167\ ) = 0.2937 = R \text{ dressing}$$

$$0.7048 \ (\ 1.0050\ ) = 0.7083 = K \text{ dressing}$$

FOURTH: To calculate the V and Y distances:

$$F = \frac{1.6958 - 0.0960}{2} = 0.7999$$

$$r_{pin} = \frac{0.09600}{2} = 0.0480$$

Then:

$$Y = \frac{0.7083^2 + 0.7999^2 - (0.2937 + 0.0480)^2}{2\ (0.7999)} = 0.6406$$

$$V = \sqrt{0.7083^2 - 0.6406^2} = 0.3022$$

Dressing the Wheel: The coordinates and radius values are set in a fixture and the grinding wheel is dressed with the diamond. After a trial cut in a dummy workpiece, it is the best practice to examine the involute profile with an involute checker. A substitute technique[2] is to use several sizes of measuring pins and compare the actual measure-

NOMENCLATURE

F	=	Center of measuring pin to center of gear
K	=	Distance at pivot from gear axis
K_u	=	Unit distance of pivot from gear axis
N	=	Number of teeth
R	=	Dressing radius
R_u	=	Unit dressing radius
r_b	=	Base radius
r_{pin}	=	Measuring pin radius
V	=	Horizontal distance of pivot point from centerline of wheel
W	=	Width of wheel flat (approximate)
Y	=	Vertical distance of pivot point from axis
ε	=	Epsilon. Symbol for degrees of involute roll or string unwinding (degrees)
ev θ	=	Evolvent θ or secant ϕ (See Fig. 6)
σ	=	Tooth space semiangle (degrees)
Φ_M	=	Main pressure angle (degrees)

Fig. 6. Representation of nomenclature for an involute arc for a unit base circle.

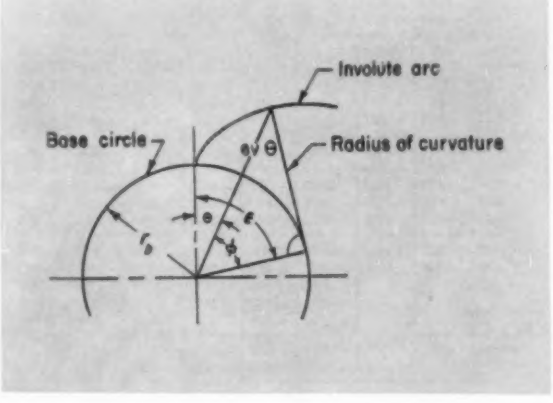
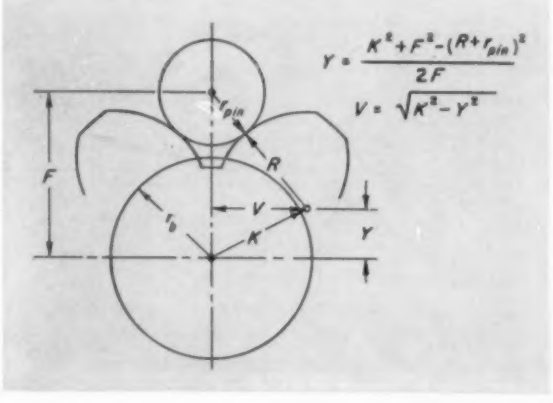


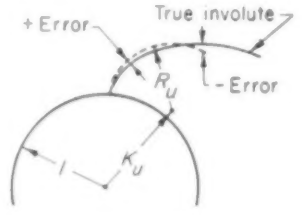
Fig. 7. With selected radius and displaced pivot the V and Y coordinates are calculated.



[2] *Precision Measuring Tools Handbook #35* — Van Keuren, Watertown, Mass., p. 136.

Table 1—Deviation of Circular Arc from True Involute (for unit grinding radii of 0.1667, 0.2167, 0.2586, and 0.3000)

		R_u = 0.1667				R_u = 0.2167				R_u = 0.2586					R_u = 0.3000				
K_u		1.0000	1.0017	1.0038	1.0067	1.0000	1.0017	1.0033	1.0067	1.0000	1.0017	1.0031	1.0050	1.0083	1.0000	1.0017	1.0033	1.0050	1.0083
ev ∅	∅																		
1.000	0	+.0002	+.0001	0	−.0002	+.0003	+.0003	+.0002	−.0002	+.0008	+.0006	+.0005	+.0002	−.0002	+.0011	+.0008	+.0007	+.0005	0
1.003	4.7	0	0	0	−.0002	+.0002	+.0002	+.0001	−.0002	+.0007	+.0003	+.0003	0	−.0003	+.0008	+.0007	+.0003	+.0003	−.0001
1.008	6.5	0	0	0	−.0002	+.0001	+.0001	0	−.0003	+.0005	0	+.0002	−.0001	−.0005	+.0005	+.0003	0	0	−.0003
1.011	8.5	0	0	0	−.0001	0	0	0	−.0003	+.0003	0	+.0001	−.0002	−.0004	+.0003	+.0002	−.0001	−.0001	−.0005
1.013	9.2	0	0	0	0	0	0	0	−.0002	+.0002	0	0	−.0002	−.0003	+.0002	+.0001	−.0002	−.0002	−.0005
1.015	10.0	0	0	0	0	0	0	0	−.0001	+.0001	0	0	−.0001	−.0002	+.0001	0	−.0002	−.0003	−.0005
1.024	12.7	−.0001	0	+.0001	+.0003	0	0	0	0	0	0	0	0	0	0	0	−.0001	−.0002	−.0004
1.032	14.5	−.0002	0	+.0002	+.0005	0	0	0	+.0002	0	0	0	0	0	0	0	0	−.0001	−.0002
1.038	16.0	−.0005	−.0001	+.0002	+.0007	−.0001	0	+.0001	+.0003	0	0	+.0001	+.0001	+.0002	0	0	0	0	0
1.045	17.3	−.0007	−.0003	0	+.0005	−.0002	0	+.0001	+.0005	0	0	+.0001	+.0001	+.0005	0	0	0	+.0001	+.0001
1.051	18.4	−.0012	−.0007	−.0001	+.0002	−.0003	0	+.0001	+.0006	0	0	+.0001	+.0003	+.0007	0	0	0	+.0002	+.0002
1.056	19.5	−.0017	−.0012	−.0005	0	−.0005	−.0001	0	+.0005	0	0	+.0001	+.0005	+.0008	0	0	0	+.0003	+.0003
1.061	20.4	−.0022	−.0015	−.0012	−.0002	−.0008	−.0003	0	+.0005	−.0001	−.0001	+.0002	+.0005	+.0008	0	0	+.0001	+.0004	+.0005
1.067	21.2	−.0028	−.0022	−.0015	−.0006	−.0010	−.0005	−.0002	+.0003	−.0003	−.0001	+.0001	+.0005	+.0008	−.0001	0	+.0002	+.0005	+.0007
1.071	22.0	−.0033	−.0027	−.0022	−.0013	−.0012	−.0008	−.0005	+.0002	−.0005	−.0003	0	+.0003	+.0008	−.0002	−.0001	+.0001	+.0005	+.0008
1.083	23.9	−.0055	−.0047	−.0037	−.0028	−.0023	−.0018	−.0013	−.0003	−.0008	−.0005	−.0003	0	+.0008	−.0003	−.0002	0	+.0005	+.0010
1.094	25.5	−.0078	−.0072	−.0060	−.0048	−.0035	−.0028	−.0022	−.0012	−.0014	−.0012	−.0007	−.0002	+.0006	−.0005	−.0003	−.0002	+.0004	+.0012
1.105	26.9	−.0105	−.0100	−.0083	−.0070	−.0050	−.0042	−.0035	−.0023	−.0023	−.0018	−.0013	−.0008	+.0003	−.0010	−.0007	−.0003	+.0002	+.0010
1.115	28.2	−.0140	−.0133	−.0125	−.0103	−.0072	−.0063	−.0055	−.0040	−.0035	−.0030	−.0025	−.0018	−.0005	−.0017	−.0013	−.0008	−.0003	+.0005
1.125	29.5					−.0090	−.0078	−.0072	−.0057	−.0047	−.0042	−.0035	−.0028	−.0015	−.0023	−.0020	−.0017	−.0010	0
1.134	30.6					−.0130	−.0105	−.0095	−.0078	−.0062	−.0055	−.0050	−.0040	−.0027	−.0033	−.0028	−.0022	−.0017	−.0006
1.143	31.7									−.0078	−.0070	−.0062	−.0053	−.0040	−.0042	−.0037	−.0032	−.0025	−.0012
1.152	32.8									−.0095	−.0088	−.0083	−.0071	−.0052	−.0055	−.0047	−.0042	−.0033	−.0022
1.169	34.7									−.0133	−.0127	−.0090	−.0112	−.0084	−.0083	−.0073	−.0069	−.0059	−.0042
1.186	36.5									−.0192	−.0180	−.0172	−.0156	−.0139	−.0118	−.0109	−.0102	−.0088	−.0075
1.202	38.2														−.0155	−.0147	−.0135	−.0125	−.0105



*Shaded areas indicate zones of least deviation.
Plus or minus values of error are indicated in drawing.
Multiply values by base radius of gear for true deviation.

Table 2—Deviation of Circular Arc from True Involute (for unit grinding radii at 0.3640, 0.4167, and 0.5000)

		R_u = 0.3640						R_u = 0.4167						R_u = 0.5000					
K_u		1.0000	1.0017	1.0033	1.0050	1.0083	1.0117	1.0000	1.0017	1.0033	1.0050	1.0083	1.0117	1.0000	1.0017	1.0033	1.0050	1.0067	1.0083
ev ∅	∅																		
1.000	0	+.0020	+.0017	+.0015	+.0012	+.0007	0	+.0032	+.0027	+.0025	+.0022	+.0015	+.0010	+.0054	+.0048	+.0045	+.0040	+.0035	+.0037
1.003	4.7	+.0015	+.0015	+.0012	+.0008	+.0003	−.0003	+.0025	+.0021	+.0019	+.0016	+.0010	+.0004	+.0049	+.0043	+.0040	+.0034	+.0030	+.0032
1.008	6.5	+.0012	+.0012	+.0007	+.0004	0	−.0005	+.0018	+.0015	+.0013	+.0012	+.0007	0	+.0043	+.0040	+.0037	+.0027	+.0024	+.0028
1.011	8.5	+.0010	+.0010	+.0005	+.0003	−.0002	−.0006	+.0017	+.0014	+.0012	+.0009	+.0004	−.0001	+.0038	+.0036	+.0032	+.0022	+.0022	+.0024
1.013	9.2	+.0008	+.0008	+.0003	+.0002	−.0003	−.0007	+.0015	+.0012	+.0010	+.0007	+.0002	−.0002	+.0034	+.0032	+.0028	+.0019	+.0019	+.0021
1.015	10.0	+.0006	+.0005	+.0002	0	−.0004	−.0007	+.0013	+.0010	+.0008	+.0005	+.0001	−.0003	+.0028	+.0025	+.0022	+.0017	+.0013	+.0015
1.024	12.7	+.0004	+.0002	+.0001	−.0001	−.0005	−.0008	+.0009	+.0005	+.0003	+.0002	−.0002	−.0006	+.0022	+.0018	+.0015	+.0010	+.0007	+.0008
1.032	14.5	+.0002	0	0	−.0002	−.0005	−.0008	+.0005	+.0003	+.0001	+.0001	−.0003	−.0007	+.0017	+.0013	+.0010	+.0007	+.0003	+.0005
1.038	16.0	0	0	0	−.0003	−.0004	−.0007	+.0003	0	0	0	−.0003	−.0007	+.0010	+.0008	+.0005	+.0002	0	+.0002
1.045	17.3	0	0	0	−.0002	−.0003	−.0005	+.0001	0	0	−.0001	−.0003	−.0006	+.0008	+.0007	+.0003	0	−.0002	0
1.051	18.4	0	0	0	−.0001	−.0002	−.0003	0	0	0	−.0002	−.0003	−.0005	+.0005	+.0005	+.0002	−.0001	−.0003	0
1.056	19.5	0	0	0	0	−.0001	−.0002	0	0	0	−.0001	−.0002	−.0004	+.0004	+.0003	+.0001	−.0002	−.0005	0
1.061	20.4	0	0	0	0	0	0	0	0	0	−.0001	−.0001	−.0003	+.0002	+.0001	0	−.0003	−.0005	0
1.067	21.2	0	0	0	0	+.0001	+.0002	0	0	0	0	0	−.0002	+.0001	0	−.0001	−.0003	−.0005	0
1.071	22.0	0	0	+.0001	+.0001	+.0002	+.0004	0	0	0	0	+.0001	0	0	0	−.0002	−.0003	−.0006	0
1.083	23.9	0	0	+.0002	+.0003	+.0005	+.0007	0	+.0001	+.0001	+.0001	+.0002	+.0003	0	0	−.0001	−.0003	−.0005	+.0001
1.094	25.5	−.0001	0	+.0003	+.0007	+.0008	+.0012	0	+.0002	+.0002	+.0004	+.0006	+.0008	0	0	0	−.0002	−.0003	+.0003
1.105	26.9	−.0002	−.0001	+.0005	+.0005	+.0010	+.0013	0	+.0002	+.0003	+.0005	+.0008	+.0011	0	0	0	−.0001	−.0001	+.0007
1.115	28.2	−.0005	−.0002	+.0002	+.0004	+.0008	+.0015	−.0001	+.0001	+.0003	+.0005	+.0009	+.0012	0	0	0	0	0	+.0007
1.125	29.5	−.0008	−.0003	0	+.0002	+.0008	+.0015	−.0002	0	+.0002	+.0005	+.0010	+.0013	0	0	0	0	0	+.0007
1.134	30.6	−.0011	−.0007	−.0003	0	+.0007	+.0013	−.0003	0	+.0002	+.0005	+.0012	+.0015	0	0	+.0001	+.0001	+.0001	+.0008
1.143	31.7	−.0015	−.0010	−.0005	−.0002	+.0005	+.0013	−.0005	−.0001	+.0001	+.0004	+.0012	+.0018	0	0	+.0002	+.0003	+.0003	+.0011
1.152	32.8	−.0020	−.0017	−.0010	−.0006	+.0003	+.0012	−.0007	−.0003	0	+.0003	+.0011	+.0018	−.0001	0	+.0003	+.0004	+.0005	+.0013
1.169	34.7	−.0035	−.0030	−.0023	−.0017	−.0007	+.0003	−.0015	−.0010	−.0006	0	+.0008	+.0017	−.0002	−.0001	+.0002	+.0005	+.0007	+.0015
1.186	36.5	−.0053	−.0047	−.0038	−.0033	−.0020	−.0008	−.0025	−.0018	−.0013	−.0008	+.0002	+.0012	−.0005	−.0002	0	+.0003	+.0005	+.0015
1.202	38.2	−.0072	−.0067	−.0058	−.0050	−.0037	−.0023	−.0037	−.0028	−.0023	−.0017	−.0005	+.0005	−.0008	−.0005	−.0002	0	+.0003	+.0013
1.217	39.2	−.0100	−.0090	−.0082	−.0075	−.0058	−.0042	−.0052	−.0045	−.0038	−.0032	−.0018	−.0005	−.0015	−.0010	−.0007	−.0003	0	+.0011
1.232	41.3	−.0133	−.0124	−.0115	−.0105	−.0090	−.0067	−.0074	−.0064	−.0058	−.0050	−.0035	−.0020	−.0025	−.0018	−.0015	−.0010	−.0007	+.0005
1.247	42.7	−.0167	−.0157	−.0146	−.0135	−.0115	−.0097	−.0092	−.0083	−.0077	−.0067	−.0054	−.0035	−.0032	−.0027	−.0023	−.0017	−.0013	0
1.262	44.1			−.0184	−.0172	−.0154	−.0129	−.0120	−.0110	−.0102	−.0092	−.0075	−.0057	−.0044	−.0040	−.0033	−.0028	−.0023	−.0010
1.276	45.4							−.0147	−.0137	−.0128	−.0118	−.0100	−.0083	−.0060	−.0053	−.0045	−.0040	−.0035	−.0023
1.289	46.7							−.0179	−.0170	−.0157	−.0148	−.0130	−.0108	−.0077	−.0068	−.0060	−.0055	−.0050	−.0035
1.304	47.9													−.0092	−.0085	−.0077	−.0072	−.0067	−.0052
1.317	49.1													−.0117	−.0107	−.0100	−.0092	−.0083	−.0069
1.330	50.3													−.0140	−.0133	−.0120	−.0112	−.0107	−.0089
1.343	51.4													−.0163	−.0157	−.0150	−.0141	−.0133	−.0117
1.356	52.6													−.0200	−.0194	−.0185	−.0167	−.0157	−.0142

Table 3—Deviation of Circular Arc from True Involute (for unit grinding radii of 0.5774, 0.6167, and 0.6667)

		$R_u = 0.5774$							$R_u = 0.6167$						$R_u = 0.6667$	
K_u		1.0000	1.0017	1.0033	1.0050	1.0067	1.0083	1.0100	1.0000	1.0017	1.0033	1.0050	1.0067	1.0100	1.0000	1.0050
ev θ	E°															
1.000	0	+.0078	+.0075	+.0072	+.0067	+.0062	+.0057	+.0052	+.0095	+.0090	+.0083	+.0081	+.0075	+.0065	+.0130	+.0108
1.003	4.7															
1.008	6.5															
1.011	8.5															
1.013	9.2															
1.015	10.0	+.0049	+.0045	+.0042	+.0037	+.0033	+.0028	+.0023	+.0060	+.0055	+.0050	+.0048	+.0042	+.0035	+.0083	+.0070
1.024	12.7	+.0040	+.0033	+.0032	+.0028	+.0023	+.0018	+.0015	+.0047	+.0045	+.0040	+.0038	+.0032	+.0025	+.0073	+.0060
1.032	14.5	+.0033	+.0028	+.0025	+.0022	+.0017	+.0013	+.0008	+.0038	+.0037	+.0032	+.0030	+.0025	+.0018	+.0064	+.0050
1.038	16.0	+.0027	+.0020	+.0018	+.0015	+.0010	+.0008	+.0003	+.0032	+.0030	+.0025	+.0023	+.0018	+.0012	+.0055	+.0042
1.045	17.3	+.0022	+.0017	+.0015	+.0012	+.0007	+.0005	0	+.0028	+.0025	+.0022	+.0020	+.0013	+.0008	+.0047	+.0033
1.051	18.4	+.0018	+.0012	+.0012	+.0008	+.0003	+.0001	−.0003	+.0023	+.0020	+.0017	+.0015	+.0011	+.0005	+.0042	+.0027
1.056	19.5	+.0015	+.0008	+.0008	+.0007	+.0002	0	−.0004	+.0018	+.0017	+.0012	+.0011	+.0008	+.0002	+.0037	+.0020
1.061	20.4	+.0012	+.0007	+.0007	+.0003	0	−.0002	−.0006	+.0015	+.0013	+.0010	+.0008	+.0005	0	+.0032	+.0018
1.067	21.2	+.0008	+.0005	+.0005	+.0002	−.0001	−.0005	−.0008	+.0013	+.0012	+.0008	+.0004	+.0003	−.0002	+.0028	+.0015
1.071	22.0	+.0007	+.0003	+.0003	0	−.0003	−.0005	−.0008	+.0010	+.0008	+.0005	+.0002	0	−.0003	+.0023	+.0010
1.083	23.4	+.0005	0	0	0	−.0004	−.0007	−.0010	+.0007	+.0005	+.0002	+.0001	−.0001	−.0005	+.0018	+.0007
1.094	25.5	+.0003	+.0002	0	0	−.0003	−.0007	−.0009	+.0005	+.0003	0	0	−.0002	−.0006	+.0015	+.0002
1.105	26.9	+.0002	0	0	−.0002	−.0005	−.0007	−.0008	+.0003	+.0002	0	0	−.0003	−.0007	+.0010	0
1.115	28.2	0	−.0002	−.0002	−.0003	−.0005	−.0006	−.0008	+.0001	0	−.0001	−.0001	−.0003	−.0007	+.0006	−.0004
1.125	29.5	−.0001	−.0002	−.0002	−.0003	−.0004	−.0005	−.0007	0	0	−.0002	−.0003	−.0003	−.0007	+.0003	−.0005
1.134	30.6	0	−.0002	−.0001	−.0002	−.0003	−.0004	−.0005	0	0	−.0002	−.0002	−.0002	−.0005	+.0002	−.0007
1.143	31.7	0	0	0	0	−.0002	−.0002	−.0003	0	0	−.0001	−.0001	−.0001	−.0003	+.0001	−.0006
1.152	32.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	−.0005
1.169	34.7	−.0001	0	0	0	0	+.0001	+.0003	0	0	0	0	+.0001	+.0002	0	−.0005
1.186	36.5	−.0002	0	0	+.0002	+.0002	+.0003	+.0003	0	0	0	+.0001	+.0003	+.0005	0	−.0004
1.202	38.2	−.0001	0	+.0002	+.0005	+.0005	+.0007	+.0008	0	0	+.0002	+.0005	+.0006	+.0009	0	−.0001
1.217	39.8	−.0003	0	+.0002	+.0004	+.0005	+.0008	+.0010	−.0001	0	+.0002	+.0005	+.0007	+.0012	0	0
1.232	41.3	−.0007	−.0004	0	+.0002	+.0004	+.0007	+.0008	−.0003	−.0002	0	+.0004	+.0007	+.0012	0	0
1.247	42.7	−.0008	−.0007	−.0002	0	+.0003	+.0005	+.0008	−.0005	−.0003	0	+.0003	+.0008	+.0013	0	0
1.262	44.1	−.0015	−.0013	−.0007	−.0003	0	+.0003	+.0007	−.0010	−.0007	−.0002	0	+.0005	+.0012	−.0002	0
1.276	45.4	−.0022	−.0018	−.0013	−.0007	−.0005	0	+.0002	−.0013	−.0012	−.0006	−.0002	+.0002	+.0010	−.0003	0
1.289	46.7	−.0027	−.0025	−.0020	−.0015	−.0012	−.0005	0	−.0020	−.0015	−.0010	−.0007	0	+.0008	−.0005	0
1.304	47.9	−.0037	−.0035	−.0028	−.0022	−.0017	−.0012	−.0007	−.0027	−.0022	−.0017	−.0012	−.0006	+.0003	−.0008	−.0003
1.317	49.1	−.0050	−.0044	−.0037	−.0032	−.0028	−.0018	−.0013	−.0033	−.0028	−.0023	−.0018	−.0012	0	−.0013	−.0007
1.330	50.3	−.0067	−.0053	−.0050	−.0044	−.0037	−.0028	−.0025	−.0043	−.0038	−.0032	−.0027	−.0018	−.0008	−.0017	−.0012
1.343	51.4	−.0080	−.0072	−.0064	−.0057	−.0048	−.0041	−.0035	−.0057	−.0052	−.0043	−.0035	−.0028	−.0017	−.0025	−.0017
1.356	52.6	−.0097	−.0087	−.0080	−.0074	−.0067	−.0059	−.0050	−.0070	−.0067	−.0057	−.0050	−.0043	−.0027	−.0033	−.0023
1.369	53.8	−.0121	−.0110	−.0100	−.0090	−.0083	−.0075	−.0067	−.0087	−.0080	−.0072	−.0067	−.0052	−.0037	−.0042	−.0030

ment to the calculated measurement. This will not necessarily show an unsymmetrical condition that may exist in the tooth profile. The optical comparator is also used to check the work profile.

If checking of the trial piece indicates unacceptable errors, it may be necessary to make a slight adjustment of either the radius or the horizontal E setting, due to diamond point inaccuracies, setup errors or misalignment with work axis. Such adjustments are customary with all types of involute dressers. Even an adjustment of 0.0005 inch affects the work profile. A heavy tip or minus pressure angle condition requires a slightly longer radius and more down feed to correct the profile. A low tip or plus pressure angle requires a slightly shorter radius and less down feed to correct the profile. Tooth profiles which extend to the base circle are highly sensitive to small changes of this nature.

In the selection of a radius of approximation, it is good design to introduce slight modifications in order to obtain quieter rolling gears and better matching spline tooth profiles. An external tooth could be made with a smaller radius than theoretical and an internal tooth space could be made more concave or with a larger radius. Since a broach produces an internal spline or gear, it, too, could be made with a larger radius than theoretical. This heavy tip and heavy root condition is also called low pitch line and produces a good bearing to avoid edge contact with its mate.

When May the Approximation Be Used? This is the important question continually arising in the spline and gear grinding field. The answer depends on the nature of the work. If the tooth to be ground is a 30-degree stub spline, and is not a tool or gage, it is possible to grind almost all internal and external splines in the SAE spline series without exceeding the commercial tolerances. Gear parts may be ground also, provided that the teeth are not large and the gears have over 30 to 40 teeth.

Gears of 14½-degree pressure angle are most difficult to approximate when the tooth profile is in the critical and curvacious zone near or at the base circle. One good rule to follow is the amount of involute roll of the profile on the tooth. The profile can be closely finished with a circular arc if the roll does not exceed 20 degrees. Fine pitches may have somewhat more—even 30 degrees. For gage accuracy, the circular arc cannot be used beyond 16 degrees on average sized teeth.

Wheel profile data for standard, 30-degree pressure angle, flat root involute splines are shown in TABLE 4. Being based on one diametral pitch, it is a simple calculation to obtain the wheel coordinates by dividing the table values by the diametral pitch.

In TABLE 5 is wheel profile data for standard 45-degree pressure angle involute serrations. The same procedure may be followed as for 30-degree splines to obtain the wheel dressing data.

Example 2: It is required to grind a 24 tooth, 20/40 pitch, 30-degree pressure angle spline shaft. Using TABLE 4 for 30-degree splines, value of $N = 24$ are employed. Since the tabulations are for a diametral pitch of one, the values are divided by 20 for a 20/40 pitch:

$$R = 6.0000/20 = 0.3000$$
$$V = 5.7852/20 = 0.2892$$
$$Y = 8.6582/20 = 0.4329$$
$$K = 10.4131/20 = 0.5207$$

These are dimensions for standard teeth and diameters. If the required tooth thickness is slightly smaller, R or V may be reduced, depending on ease of adjustment.

In some cases where a modified profile is desired, such as a high pitch line, the deviation tables may be used to determine the proper radius and location.

Accuracy of Arc: If it is required to determine the accuracy of the circular arc, TABLES 1, 2 and 3 may be used in reverse. Using the results of Example 2 where $R = .3000$ and $K = 0.5207$, it is also necessary to obtain the shaft major diameter, the true involute form diameter and the base diameter. From *ASA* B5.15-1950 *Spline Standards*, these are:

Major diameter = 1.250
TIF diameter = 1.150
Base diameter = 1.0392

Then:

$$\frac{R}{r_b} = R_a = 0.5774$$

$$\frac{K}{r_b} = K_a = 1.002$$

To obtain the range of the involute profile:

$$\frac{1.250}{1.0392} = 1.203 = \text{ev } \theta \text{ value at the major dia.}$$

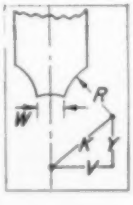
$$\frac{1.150}{1.0392} = 1.107 = \text{ev } \theta \text{ value at the TIF dia.}$$

Using TABLE 3, select the 1.0017 column in the $R_a = 0.5774$ group. Fixing the ev θ limits in the first column, read across to the 1.0017 column. Here it can be seen that the profile deviates only 0.0002 inch for a unit base radius. The actual deviation is 0.5196 (0.0002) or 0.000104.

Table 4—Wheel Dressing Data for 30-Degree Involute Splines

Do not use below 10/20 DP for close accuracy

N	R	V	Y	K	W Approx.
6	1.6022	1.9565	1.7886	2.6319	1.07
7	1.8692	2.1673	2.1622	3.0614	1.03
8	2.1362	2.4067	2.5394	3.4987	1.00
9	2.4032	2.6448	2.9151	3.9361	
10	2.5000	2.7515	3.3994	4.3734	
11	2.7500	2.9683	3.7756	4.8027	.99
12	3.0000	3.1840	4.1502	5.2308	
13	3.2500	3.3984	4.5228	5.6573	
14	3.5000	3.6116	4.8938	6.0822	
15	3.7500	3.8303	5.2721	6.5166	
16	4.0000	4.0476	5.6485	6.9490	.98
17	4.2500	4.2659	6.0262	7.3833	
18	4.5000	4.4840	6.4032	7.8176	
19	4.7500	4.7021	6.7812	8.2519	
20	5.0000	4.9200	7.1585	8.6862	
21	5.2500	5.1378	7.5357	9.1205	.98
22	5.5000	5.3556	7.9129	9.5549	
23	5.7500	5.5706	8.2857	9.9842	
24	6.0000	5.7852	8.6582	10.4131	
25	6.2500	6.0028	9.0346	10.8470	
26	6.5000	6.2177	9.4072	11.2763	.98
27	6.7500	6.4310	9.7777	11.7030	
28	7.0000	6.6481	10.1536	12.1364	
29	7.2500	6.8651	10.5296	12.5699	
30	7.5000	7.0786	10.9001	12.9969	
31	7.7500	7.2919	11.2701	13.4234	98
32	8.0000	7.5087	11.6456	13.8564	
33	8.2500	7.7254	12.0210	14.2894	
34	8.5000	7.9422	12.3964	14.7224	
35	8.7500	8.1589	12.7718	15.1554	
36	9.0000	8.3757	13.1472	15.5885	.97
37	9.2500	8.5926	13.5225	16.0215	
38	9.5000	8.8091	13.8978	16.4545	
39	9.7500	9.0258	14.2731	16.8875	
40	10.0000	9.2425	14.6484	17.3205	
41	10.2500	9.4591	15.0237	17.7535	.97
42	10.5000	9.6758	15.3990	18.1865	
43	10.7500	9.8925	15.7742	18.6195	
44	11.0000	10.1091	16.1495	19.0526	
45	11.2500	10.3258	16.5247	19.4856	
46	11.5000	10.5424	16.8999	19.9186	.97
47	11.7500	10.7591	17.2751	20.3516	
48	12.0000	10.9757	17.6503	20.7846	
49	12.2500	11.1923	18.0255	21.2176	
50	12.5000	11.4089	18.4007	21.6506	

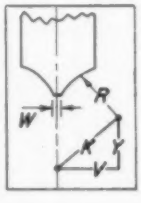


*Wheel dressing data for standard ASA 30-degree involute splines of 1 diametral pitch. For other than 1 DP divide table values by the given DP

Table 5—Wheel Dressing Data for 45-Degree Involute Serrations

N	R	V	Y	K	W
6	2.1213	1.8317	1.1438	2.1595	
7	2.4749	2.0926	1.4030	2.5194	
8	2.8284	2.3386	1.6506	2.8624	
9	3.1820	2.5953	1.9064	3.2202	
10	3.5355	2.8347	2.1482	3.5567	
11	3.8891	3.0889	2.4016	3.9124	
12	4.2426	3.3420	2.6548	4.2681	
13	4.5962	3.5950	2.9078	4.6238	
14	4.9500	3.8480	3.1603	4.9794	
15	5.3033	4.1007	3.4129	5.3351	
16	5.6569	4.3533	3.6653	5.6908	
17	6.0104	4.6056	3.9177	6.0465	
18	6.3640	4.8580	4.1699	6.4022	
19	6.7175	5.1101	4.4220	6.7578	
20	7.0711	5.3623	4.6741	7.1135	
21	7.4246	5.6144	4.9260	7.4691	
22	7.7782	5.8492	5.1624	7.8015	
23	8.1317	6.1004	5.4136	8.1561	
24	8.4853	6.3516	5.6649	8.5108	
25	8.8388	6.6027	5.9159	8.8653	
26	9.1924	6.8539	6.1670	9.2200	
27	9.5459	7.1049	6.4181	9.5745	
28	9.8995	7.3489	6.6624	9.9193	
29	10.2531	7.5846	6.8993	10.2531	
30	10.6066	7.8348	7.1496	10.6066	
31	10.9602	8.0850	7.3998	10.9602	
32	11.3137	8.3353	7.6501	11.3137	
33	11.6673	8.5855	7.9003	11.6673	
34	12.0208	8.8357	8.1505	12.0208	
35	12.3744	9.0859	8.4007	12.3744	
36	12.7279	9.3361	8.6509	12.7279	
37	13.0815	9.5863	8.9010	13.0815	
38	13.4350	9.8364	9.1512	13.4350	
39	13.7886	10.0866	9.4013	13.7886	
40	14.1421	10.3368	9.6515	14.1421	
41	14.4957	10.5869	9.9016	14.4957	
42	14.8492	10.8370	10.1518	14.8492	
43	15.2028	11.0872	10.4019	15.2028	
44	15.5564	11.3374	10.6520	15.5564	
45	15.9099	11.5874	10.9021	15.9099	
46	16.2635	11.8376	11.1522	16.2635	
47	16.6170	12.0877	11.4024	16.6170	
48	16.9706	12.3377	11.6525	16.9706	
49	17.3241	12.5879	11.9025	17.3241	
50	17.6777	12.8379	12.1527	17.6777	

APPROX. 0.7 TO 0.8



*Wheel dressing data for standard ASA 45-degree involute serrations of one diametral pitch. For other than 1 DP divide table values by the given DP.
BASED ON:

$$\frac{1.3708}{DP} = \text{CIR. T.T}$$

LIMITATIONS
Of Investment Cast Tool Alloys

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AN ALLOY COMPOUNDED to secure a set of properties in rolled, wrought or forged state will not provide all of its potential mechanical and physical properties when used in the cast condition. The distribution of alloy constituents in the cast structure is completely different from the forged structure. In large cast sections, rarely met in investment castings, alloy segregation may be so severe that surface layers of the cast ingot or piece may be totally different in composition from the center. Between the edge and center there is a progressive differentiation due to the selective pattern of solidification. The highest melting composition, usually the iron-carbon matrix, will freeze at the surface first. The lower melting constituents, which are normally richest in alloy constituents, will migrate towards the center.

In severe segregation conditions, the core of a thick section may be composed of an alloy-rich eutectic completely different from the balance of the cast structure. In the steel mill this is a major problem only partially compensated for in the upsetting, rolling, trimming and heat treating of the mill stock. Often a given ingot will yield different alloys or grades from the base, center and top portions. Other factors than segregation are part of this differentiation.

The composition of most alloys in use has been worked out considering limitations imposed upon the mill ingot stock. Its segregation tendency, piping, direct count, hot shortness, edge tearing, surface cleanliness and many other details important to the quality and yield of the mill product are all criteria in the development of an alloy.

These factors are not pertinent to an alloy melted in small quantities of no more than 300 pounds per heat for investment castings which rarely exceed 15 lb. While mill limitations of a composition are not relevant, other conditioning factors are. Some of these are the tendency of the alloy to react with melting or pouring equipment, the activity of the metal in contact with the investment mold and the inherent cleanliness of the alloy plus the ease of degassing or fluxing it in small masses. The size of the cast grain is an incidental detail which has been tremendously over emphasized.

Grain size in a mill product usually can be considered an indication of the thoroughness with which the initial ingot has been broken down and the cast structure recrystallized by hot working and heat treatment. Smallness of grain implies nothing more than uniformity of alloy composition in a given piece of metal. A highly worked piece of metal of whatever composition will usually reveal a small grain size. Where coarse grain occurs under these conditions, it is usually an indication of overheating of the metal during process heat treatments. Such coarsened metal is weak or defective. The weakness is due not so much to the large grain size as to the fact that the grain boundary constituents have been oxidized or otherwise decomposed.

Past overemphasis on fine grain structure in the forged product has focused attention on this detail in the investment cast product, with the result that many alloys are being investment cast because they happen to have a fine grain as cast, or as cast and heat treated. Other alloys, inherently coarser grained when investment cast, have been discounted or avoided in the preference for the finer structures.

Recent metallurgical investigations of typical alloy steels commonly used for structural and tool castings were made by the author with the co-

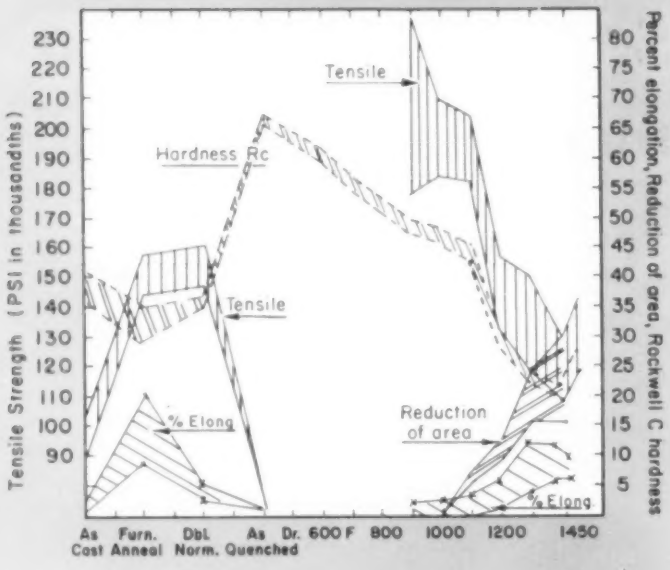


Fig. 1. Physical and mechanical properties of investment cast SAE 52100.

operation of the Arwood Precision Casting Co. Some of the results secured have been published elsewhere, (see *Investment Castings for Engineers*, Von Ludwig, Wood; Reinhold Pub. Co.). Additional conclusions are offered herein.

The investment casting industry is still too young to have a large pool of empirical information derived from wide experience. Little controlled metallurgical investigation has been carried out, except on the high temperature alloys based on nickel and cobalt or other refractory compositions, where military interests and funds have underwritten the expensive test programs.

To make a complete study of any single alloy entails the preparation of thousands of specimens from many separate melts. Gating influences, mold temperatures, melting equipment, chemistry and operation, pouring temperatures and techniques must all be separately evaluated. Obviously the accumulation of this type of precise data will require years of work.

The recent investigations referred to consisted of making in excess of 2,000 tensile specimens from three to ten separate melts of SAE 52100, SAE 4130 and 4140, SS 410 and 440, as well as some random melts of representative austenitic, type 302, 303 and 304 stainless steels. Of these alloys, SAE 52100 and martensitic stainless type 440 are alloys most commonly employed to cast tool components.

The high carbon, chrome-vanadium bearing steel, SAE 52100, *Fig.* 1, has been highly touted in the past by various investment founders as an exceptionally valuable alloy. This was predicated upon the most rudimentary evidence, consisting in the main of the foundry knowledge that the alloy was fluid and fine details were sharply defined, and the metallurgical fact that the fracture of the investment cast SAE 52100 specimens revealed a fine grained structure. Some foundry metallurgists placed themselves and their respective companies out on a limb by advocating this composition in various heat treated conditions for wear resistant, high hardness tools, for impact resistant structural castings, as well as for many ordinary applications.

There are strong indications that totally different methods of heat treatment, coupled with more controlled techniques of melting, refining and casting this and related metals, can produce far better physical properties than those indicated by these curves, *Fig.* 1. The properties shown must be considered as typical of the forms of ferrous, high hardness tool alloys as they are currently cast by commercial investment foundries. Published claims of mechanical properties far exceeding those shown are not founded on fact. The tool design engineer must take full cognizance of the obtainable properties of the metals he wishes to use, not the desired properties.

The accompanying series of photomicrographs, *Figs.* 2-10, were made at 2800 diameters of specimens of SAE 52100 selected at random from tensile specimens made from seven different heats of metal heat treated as indicated. The curves for physical properties, *Fig.* 1, were derived from the examination of the good tensile specimens contained in an initial group of more than 700 specimens.

It is at once apparent that the microstructural modification of this alloy is satisfactory and uniform. Response to the different heat treatment and tempering stages is normal. The alloy, however, is rather distinct among the ferrous metals studied as

far as its grain refinement during double normalizing is concerned. The microphotos, *Figs.* 2 and 4, show a definite improvement in structure is secured by normalizing. Unfortunately, the physical property tests made with tensile bars did not disclose any measurable, reliable improvement in tensile strength or elongation, with the better microstructure.

Alloy 52100 is in fact unreliable in all conditions of hardness, as cast, as normalized, as quenched and as tempered, *Figs.* 2-10, until it has been drawn back to a hardness level under 45 Rockwell C. There obviously is no point in using an alloy which has its chief merit in wear resistance, secured only when hardened to more than 58 Rockwell C, if the properties of impact resistance or toughness are absent. For some applications a part need have no dynamic properties. High hardenability alone is the prerequisite. The good foundry properties and ready response of SAE 52100 to hardening heat treatment may justify such usage.

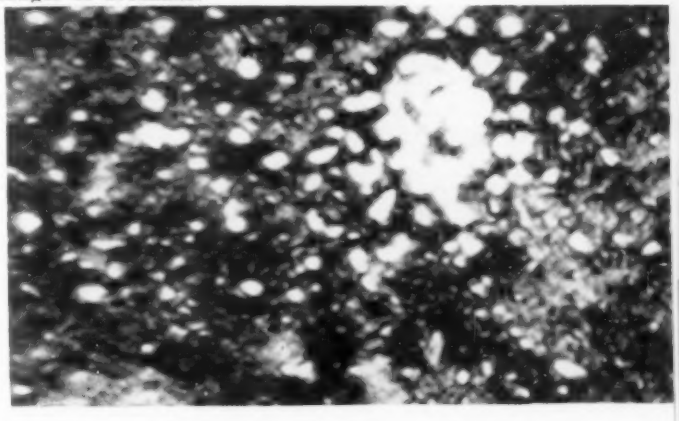
The tool designer must bear in mind the fact that most high alloy steels, when hardened, possess low impact resistance. This is true whether the alloy is cast or forged. In some alloys, such as SAE 52100, notch sensitivity appears to be aggravated in the investment cast form. This necessitates securing uniformly smooth, polished surfaces on the parts. The designer must incorporate correct radii in all section changes. The ability to employ cast radii in part mitigates the notch sensitivity of the hardenable steels, in contrast with the impracticability of machining radii into forged similar parts. The higher shock resistance of the forged structure can be totally lost by machining abrupt, unrelieved, corners in a product design.

The problem of control of impact strength in the investment cast form of alloys such as SAE 52100 is aggravated by metal turbulence. When the investment mold is filled, minute oxide folds may form in the casting surfaces unless the design is such that a method of gating can be employed which will permit the metal to fill the mold cavities without turbulence or metal spurting. These folds may not be removed during grinding and can then become the foci for fatigue or impact fractures.

By no means are all investment cast alloys susceptible to this defect. Good design and foundry practices can control it in parts made from sensitive alloys such as SAE 52100.

Type 410 martensitic stainless is an alloy not highly regarded by investment foundries, due to difficulties of securing a good, smooth surface finish. Tests made with it and closely related alloys such as type 420 and 440 indicate that the potential hardenability by direct quenching and tempering may not be as high as such alloys as SAE 52100. Nor are the tensile properties as high, in lower tempers, as SAE 4140. Yet the martensitic stainless alloys are far cleaner and more uniform than these

Fig. 2. Pearlite in investment cast structure of SAE 52100, 2800 magnification. In this condition the metal is too brittle to remove from the mold without danger of breakage.



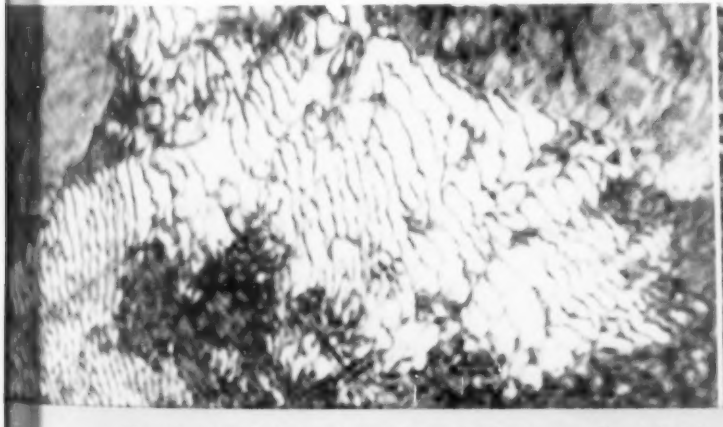


Fig. 3. (left) High percentage of island or spheroidized cementite, 2800 X. The molds containing the castings were annealed at 1500 F until heated uniformly, then furnace cooled 12 to 24 hours to improve the impact resistance of the metal and permit removal of the delicate castings. Fig. 4. (right) Double Normalized structure of SAE 52100, 2800 X. Definitely modified, it is not as strong or impact resistant as the full annealed metal.

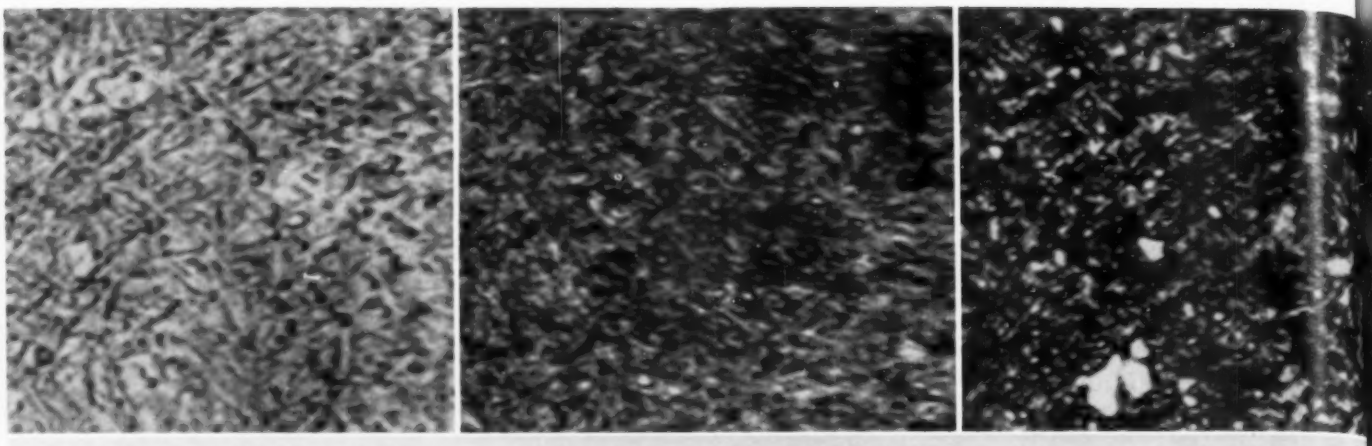


Fig. 5. (left) Martensite structure of 52100, 2800 X. Black particles of excess graphite are visible. This condition is produced by quenching in oil from 1525 F; the metal has no measurable impact resistance, elongation in tension, reduction of area or dependable tensile strength. Fig. 6. (center) Quenched SAE 52100 tempered at 600 F. This refines the structure and decomposes some of the martensite, lowers hardness but fails to produce reliable tensile properties or impact strength. 2800 X. Fig. 7. (right) SAE 52100 tempered at 800 F. Hardness is further lowered to 50 Rockwell C or less. Microstructure begins to coarsen, though no change in macrograin size is apparent. 2800 X.

other metals, SAE 51200 and 4140, at least internally.

It is better practice to design for an alloy intrinsically uniform, although possessing apparently less desirable properties than it is to attempt to use an uncontrollable alloy possessing properties only superficially better.

The martensitic alloys are inherently coarse grained when investment cast, and so far no techniques of heat treatment have been perfected which can refine this structure appreciably. It is interesting that many indications tend to show that for many purposes a coarse grain in the cast structure is more enduring than fine grain. Studies of turbine bucket alloys by Dr. Grant of M.I.T. have shown this to be true for high temperature.

Little has been done to develop heat treatment techniques specifically for processing small metal sections common to investment castings. Indications are, however, that the most desirable practices entail surface hardening of annealed structures. Where a high degree of wear resistance is required, plus some stability of dynamic properties, it is wise to require a full anneal be given to the base metal to produce the most ductile structure for the core. The wear resistance can then be secured by cyaniding, case carburizing, nitriding or carbonitriding.

SAE 52100 may be adequately hardened to produce cases measuring 64-67 Rockwell C over the spheroidized structure by carbo-nitriding. Plain nitrided cases are susceptible to spalling, because the high carbon pressure in the surface of the 100 point steel tends to produce a nitride case which is too brittle to adhere. By balancing or over balancing the surface carbon pressure, while nitriding the surface, an adherent, reasonably ductile spall resistant case is secured. Similar treatments may be given to lower alloy steels by case hardening processes. SAE 4140 is much less sensitive to turbulence and to edge notch failures than SAE 52100 in the investment cast form. Good combinations of wear resistance and strength may be secured by using 4140 after heat treating the casting to produce a high strength, ductile structure. The investment cast alloy is not improved by normalizing and tests tend to indicate it is harmed by double normalizing where routine treatments intended for mill or sand cast structures are used. Wear resistance can be imparted to the heat treated cast 4140 by suitable case carburizing or cyaniding. Several of the nitralloy compositions may be satisfactorily investment cast for use instead of SAE 52100 where the nitrided case is desired. Data is inadequate to indicate whether the nitralloy compositions are any more reliable than SAE 52100 in this condition.

Past attempts to investment cast intricate cutting tools from high alloy metals have shown contradictory results. In some instances, the cast hobs, milling cutters, broaches, etc., have outperformed comparable pieces machined from forged tool steel. In others, failures have been pronounced.

The conclusion which may be legitimately derived from tests performed to date are that the alloys which were transposed to the investment cast form for comparison purposes were inherently unsuited for use as cast and heat treated where the usual techniques of hardening were employed. The judicious selection of alloy and of hardening technique would probably eliminate the deficiencies previous-

ly experienced. There is no logic in using an alloy in investment cast form because it was satisfactory for a given application as normally machined from mill stock. The properties in the casting simply cannot be the same. It is quite possible, however, to secure far better properties in an investment cast tool if care is given to alloy selection and to the method of heat treatment utilized in finishing the tool.

Stellite and Hastelloy metals offer many design and performance advantages in their investment cast forms. Use of these metals is limited at present due to their unavailability. Of the thousands of different ferrous tool steels, there are undoubtedly many which can be highly satisfactory as investment cast. Of these, experience has shown that the high-carbon, plain steels are most unsatisfactory. The high-carbon high-chrome alloys produce uniform results, in spite of inherently large grain sizes, but the properties, while uniform, are low in comparison to those which may be secured by the proper casting and treatment of other ferrous metals.

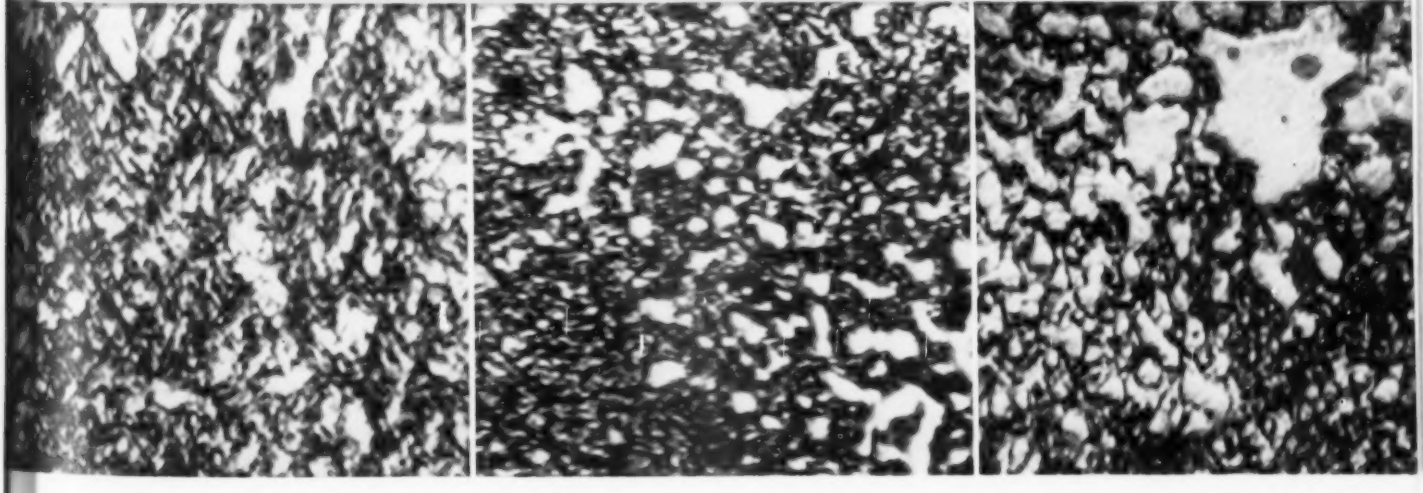
A good initial rule for the tool designer to consider in attempting to employ investment castings of most steels is that the wholly hardened structure can seldom be counted on to have impact resistance. While more costly, a tough core and a hard case is better than a through hardened, though slightly tempered, part. This is clearly illustrated by the impact resistance of SAE 52100. This fails to improve when quenched and tempered, until the metal has been tempered at 900 to 1000 F, following which it is usually too soft to provide the desired wear resistance. If it is annealed, however, preferably spheroidized, and then correctly case hardened, quite satisfactory performance results.

The designer should not attempt to duplicate properties when converting a machined component to an investment casting using the same alloy. Probably the required properties can be best secured by using some other metal. Until more information is available on metallurgy of investment cast alloys, the safest practice is to consult with the intended sources of supply and be guided by their recommendations. These should be supplemented by destructive testing, by fracturing and otherwise examining the initial or development samples of a new investment cast part. It is wise practice to make periodic tests of production runs of critical parts by fracture testing the most critical details. This is to make certain no changes in gating or other foundry manipulations have given rise to oxide inclusions, grain boundary films or surface turbulence films, all of which must be avoided.

During the investigations cited it was found that X-ray control cannot disclose the grain boundary films which are occasionally encountered in alloys such as SAE 52100 or SAE 4140. These films can be prevented in the foundry by gating and pouring control, but it is incumbent on the consumer of the castings to call attention to the presence of such defects by proper inspection of sample parts and by adequate production inspection. Since X-ray will not disclose such flaws, either Zyglo, Magnaflux or fracture testing must be relied on for adequate quality control.

If these principles are considered in designing investment cast tools and constituent parts, the potential flexibility of investment casting techniques may be more adequately utilized by the tool design engineer than in the past.

Fig. 8. (left) SAE 52100 tempered at 1000 F. Further coarsening of micrograin is noticeable, with marked increase in cementite and intermediate decomposition forms of martensite. 2800 X. Fig. 9. (center) SAE 52100 tempered at 1200 F. Spheroids of cementite tend to form. There is a marked improvement in impact strength. 2800 X. Fig. 10. (right) SAE 52100 tempered at 1450 F. This completes the transformation of structure imparted by quenching. A slight increase in tensile properties is secured. 2800 X.



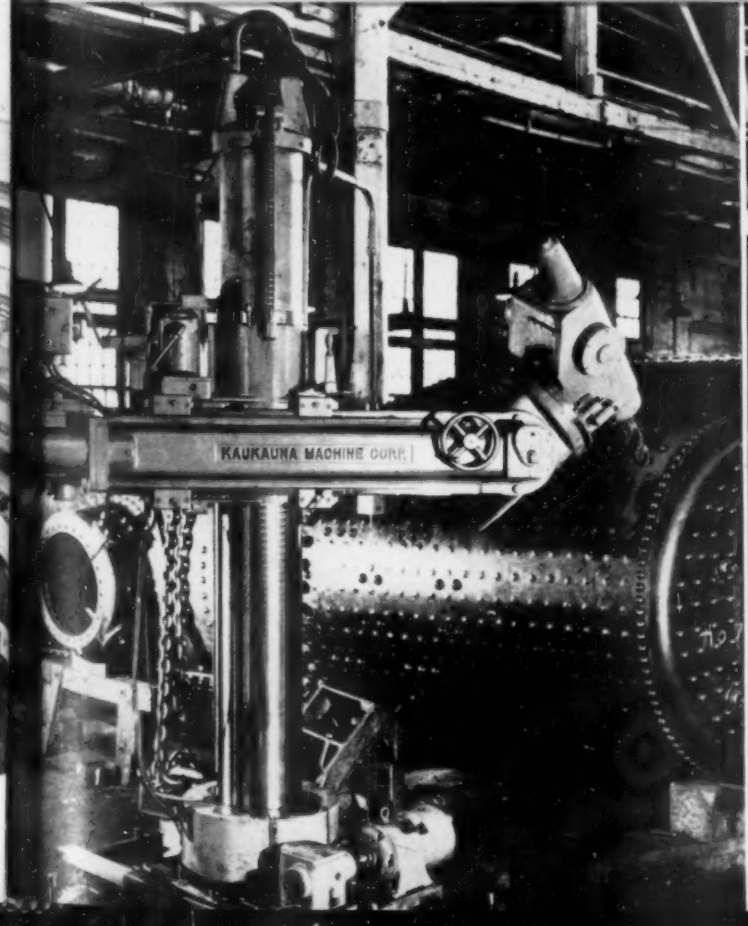
TOOLS at work

Left. Job shop versatility is achieved in this line of Danly presses operating on short runs under 5000 pieces. Two smaller dies in each press double output and utilize press room capacity to the fullest extent in this straight line production operation.

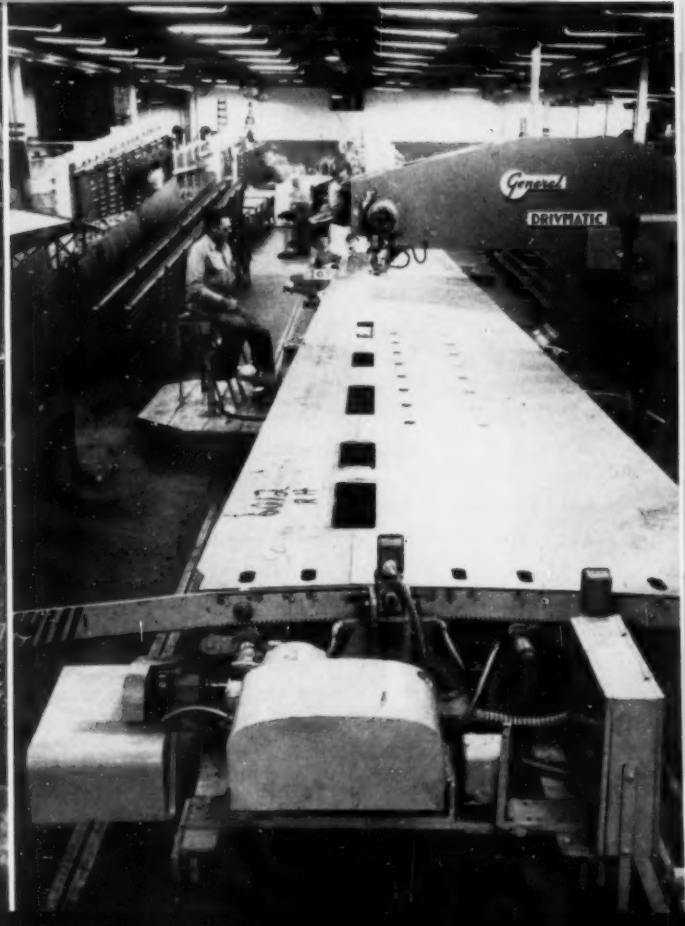
Below. Semidirect lighting in the new Norton Co. Plant in Worcester, Mass., eliminates sharp contrasts usual in industrial lighting, adds warmth and comfort to promote morale and efficiency. Twenty percent of total light is directed upward through large slots in top of the luminaires.

Right. Optical form grinder at Eglinton Carbide Products, Inc., finishing a tungsten carbide die section to a precision scribed template projected on the screen behind the silhouette of the diamond wheel and the workpiece. Magnification of 20 to 1 permits grinding the irregular die shape to 0.0001 inch. The grinding wheel has a hydraulic feed and return with manual control of vertical and lateral motion.

Below. Moved to the job, a swivel-head drilling and tapping machine drills a 2¾-inch hole, in a locomotive steam boiler, for tapping with a pipe thread at Vulcan Iron Works.



Below. Automation in aircraft riveting moved a step closer with the development of pushbutton positioning of Lockheed's Drivmatic riveter. Temco Aircraft replaced hand cranked lateral shifting of the table with an electrically operated remote control mechanism which has resulted in greater efficiency, saving four to eight hours on each outer wing panel.



WELDING
Tools and Dies

By Harold S. Card

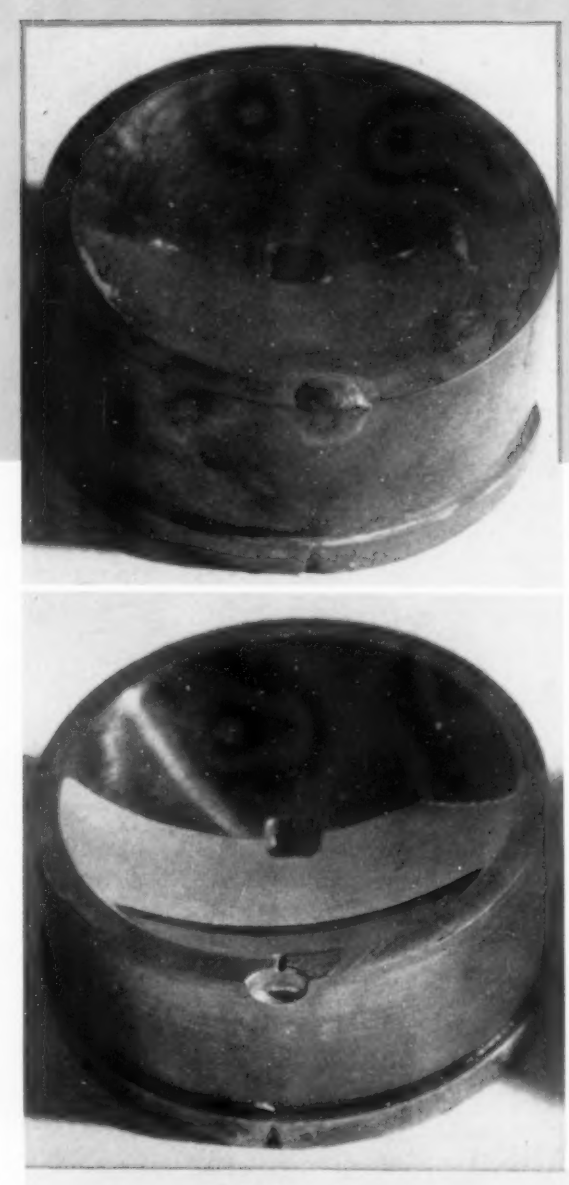


Fig. 1. This plastic molding die was nicked on the edge. Blemishes were prevented by cleaning with a suitable solvent.

FUSION WELDING APPLIED to the salvage and repair of worn or damaged tools and dies generally results in savings which are out of proportion to the amount of actual welding done on individual pieces. The material saving, in spite of the high cost of tool and die steels, is relatively unimportant. Time saving is what counts most and it runs into big money.

Only a few plants have set up special welding departments to do tool and die welding. Thousands of plants with smaller requirements depend on commercial welding shops that are qualified for this specialty. These shops receive their work from diversified sources, including some that are steady customers and others who bring in one job in a lifetime. The processes generally employed are the metallic arc process and the atomic hydrogen process.

As a production method, fusion welding is a satisfactory process for use in the manufacture of new composite dies having a base or body of tough machine steel and a working or cutting edge of an alloy steel. Savings are appreciable over machining the piece from a solid block of more costly tool steel because the amount of welding time and welding material used is relatively small.

Often more important than the saving of tool steel is the time saving accomplished by fabricating a composite tool on a body of readily available steel instead of waiting for delivery of the special alloy steel wanted. The welding shop for this type of welding must carry a varied stock of filler rods from which a suitable material can be selected to provide the required working properties.

In tool and die jobs for repair and salvage, fractures are the exception. As a rule, there is a badly worn working edge to be rebuilt, a piece chipped out of a working edge, a mistake in machining, a change in design of the product, or a defect in the die material which can be corrected by welding. These are all building-up jobs, mostly in easily accessible locations.

Hard facing materials are sometimes suggested for repairs on worn dies. In most cases this is not a job for hard facing and the filler metals that are used are not suitable for tool and die service. Hard facing metals acquire their maximum hardness as deposited, without heat treatment. Filler metals

most suitable for tool and die work are alloy steels which require heat treatment to develop maximum hardness.

Filler metal selected for a certain application will usually be of the same general type as the parent metal: water hardening high carbon tool steel; oil hardening tool steel; air hardening, high chromium, high carbon tool steel; high-speed steel; or hot work steel. An exact duplication of the parent metal composition would not necessarily carry over into the deposit because some alloys are likely to be lost in the process. The closer the weld deposit matches the parent metal in chemical composition, the closer it will match in response to heat treatment and principally what is wanted is to restore the piece to its original hardness, toughness and serviceability. Hard facing is almost always used to improve the wearing quality of a part. In tool and die repairs, be well suited to this kind of work because it provides a concentrated, extremely high temperature flame, plus a means of surrounding the weld area with a nonoxidizing atmosphere. Oxidation, the chief source of porosity, is avoided and the skilled operator can make his weld before the piece absorbs too much heat.

In atomic hydrogen welding, the tool used is very similar to the familiar carbon arc torch. The electrodes, however, are slender tungsten rods, and the electrode holder is of more complex design. It is constructed with passages around the electrodes so that a stream of hydrogen gas can be made to blanket the arc. This gas envelope prevents oxidation of the weld metal and cleans up any surface oxides that may be present, thus assuring a weld area free of porosity. It also produces a unique heating effect on the surface of the workpiece. The

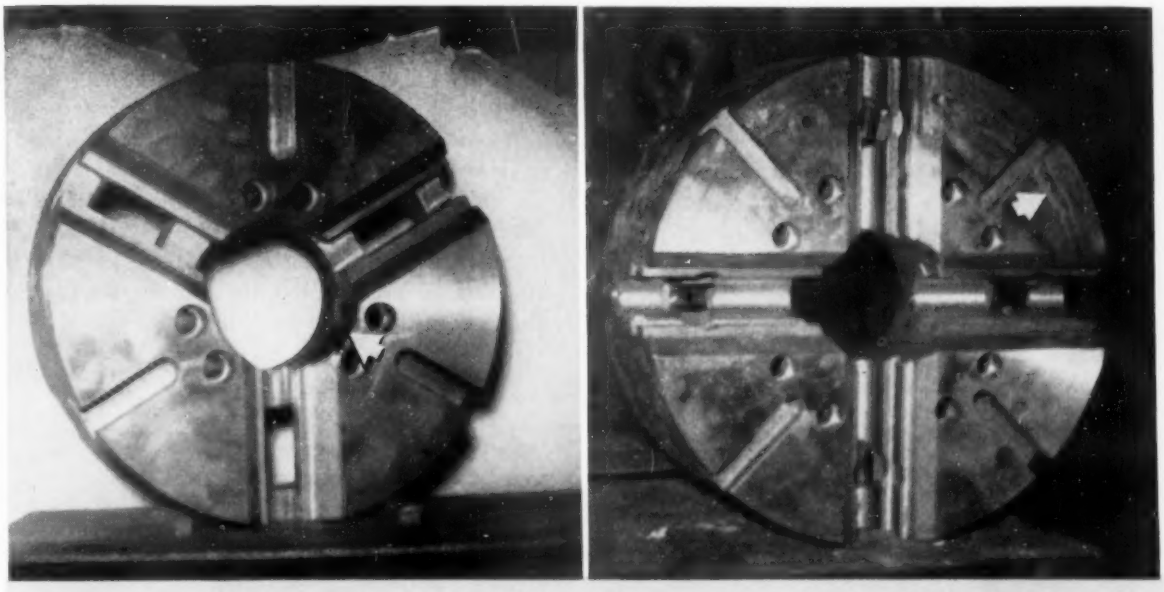


Fig. 2. Damaged chucks are quite common. The one at left was nicked with the cutter on the edge of the hub, while the chuck at the right was hit in a few places by the cutter and gouged halfway round.

it is undesirable to change the working properties more than necessary.

No great welding problem is involved in fusing a deposit of alloy steel to a damaged die. The problem is to do it without unduly enlarging the grain structure of the piece, without having cracks develop underneath the weld, and without leaving any porosity in or near the weld. These are all possible heat effects and sources of progressive fracture under load. The objective, then, is to fuse a relatively small amount of weld metal to a thick, heavy piece and do it with the least possible metallurgical disturbance, avoiding oxidation completely. The atomic hydrogen arc-welding process has proved to

explanation of the extremely high flame temperature developed is that the hydrogen molecules passing through the arc are dissociated into atoms by the heat of the arc and absorb large amounts of heat in the process. On reaching the work surface, the atoms recombine into molecules and give up the heat that was absorbed. This concentration of heat allows the welder to deposit his bead with a minor input of heat into the workpiece.

These favorable characteristics of the atomic hydrogen process for tool and die welding do not make it foolproof. Whatever fusion process is used, the job plan must take into account the facts that: (1) the deposit will not have undergone the same

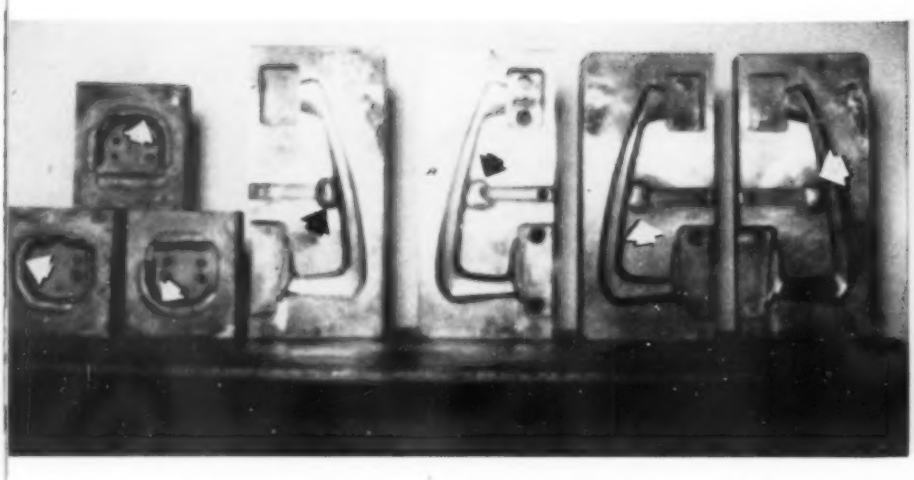


Fig. 3. The three smaller dies at the left had small cracks around the edges. The four larger molds had been damaged at various places by chipping.

heat treatment as the parent metal; (2) the heat of welding will modify the properties of the heat-treated parent metal in a localized zone adjacent to the deposit; (3) if the piece is welded cold, shrinkage stresses are likely to cause checking or cracking under the deposit when it cools. Fortunately, these are not formidable obstacles.

To develop uniform, optimum properties throughout the welded piece, it is obviously desirable to anneal before welding, to weld with a filler rod that will leave a deposit having heat-treating characteristics similar to those of the parent metal and to heat treat after welding to secure the desired hardness. This procedure should take care of the first two problems enumerated in the preceding paragraph. Shrinkage cracks and checks are avoided by preheating the workpiece to about 300F, or to slightly below the minimum tempering temperature if a full anneal is not given before welding.

Welding time is relatively short on a great deal of this work. The preparation and the after treatment combined take several hours. Shortcuts are possible, even practical, when the man in charge knows his metals and his procedures, and when the maintenance of all properties is not critical. But at best there is little to be gained by saving minutes to justify the risk of a later failure caused by hurrying the job.

Deposition technique is much the same as with oxyacetylene welding. The arc flame is played on the work surface to produce a molten pool and the filler rod is melted into the pool under the arc. Intensity of heating can be controlled by varying the distance between the arc and the work. The usual range of welding conditions is:

Electrode Diameter	1/16 to 1/8 inch
Weld Current	21-75 amps
Hydrogen Pressure	6-1- psi

Preparation of the workpiece is not difficult. Standard practice is to grind or machine a shallow-

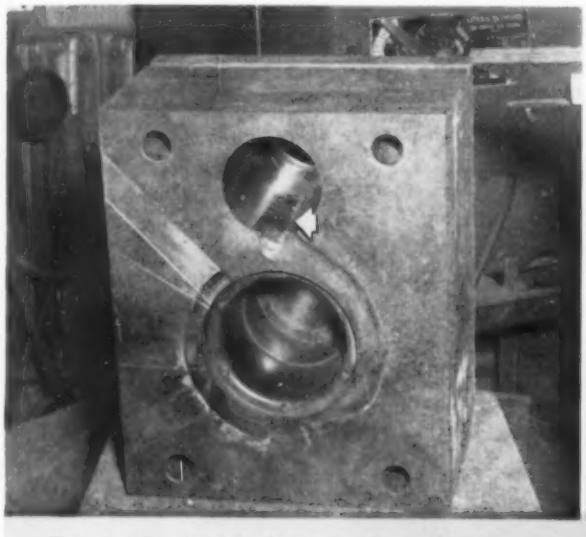


Fig. 4. On larger pieces, such as this water-cooled die casting die, a composite welding procedure is used.

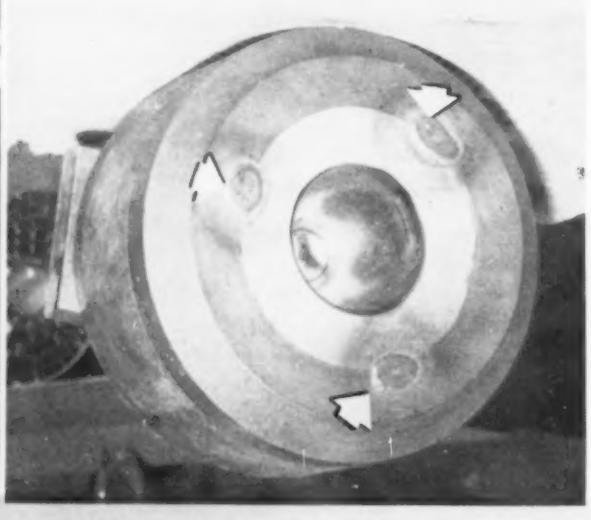


Fig. 5. The three small welds shown here are for temporary bonding to hold the forming die in the round bed.

radius groove for the deposit. Good results cannot be obtained by depositing on a sharp edge or in the bottom of a V; adhesions and checking are almost inevitable.

Thorough cleaning of the workpiece is another item of preparation which must not be overlooked. A die which has been in service for some time may have soaked up oil or other impurities which will make it difficult to weld without porous areas. *Fig.* 1 is an example. This is a plastic molding die which was nicked on the edge. Grinding out the hollow to receive the deposit removed all foreign matter from directly below the bead, but a thin film of plastic at the edge could introduce just enough porosity to blemish the mirror surface of the die. This was prevented by cleaning with a suitable solvent.

The final step in preparation of the work is preheating the piece so that the chilling effect of the parent metal on the deposit will not be too drastic. Slow, even heating is best. Then if the welder lays his bead quickly and neatly and covers it to assure even cooling, subsequent heat treatment will have the best possible chance of restoring the desired balance of hardness and toughness to the tool. Damaged chucks are quite common in all sizes. Those shown in *Fig.* 2 are about 20 inches in diameter. The chuck at the left in *Fig.* 2 was nicked with the cutter on the edge of the hub as shown. The chuck at the right, *Fig.* 2, was hit in a few places by the cutter and gouged around half the circumference. The alloy filler rod used on these chucks contains: C...0.15-0.20; Mn...0.30-0.60; Si...0.15-0.75; Ni...3.25-3.75 percent. The deposit from this rod has good strength, hardness and impact resistance, requires a relatively low heat-treating temperature and resists scaling, warping and cracking.

Fig. 3 shows two groups of small plastic die molds of low carbon, low chromium steel. The three smaller ones at the left had small cracks around the edges. The four larger molds had been chipped in various places. The composition of the repair was an alloy with: C...0.10-0.20; Mn...0.30-0.60; Cr...0.80-1.10; V...0.15-0.18 percent.

When there is a relatively large amount of filling to be done, as in the case of partial or complete fracture, it is customary to use a composite welding procedure. The water-cooled die casting die in *Fig.* 4 is 15 x 18 inches, $10\frac{1}{4}$ inches thick. The upper hole is $4\frac{1}{4}$ inches in diameter and the lower hole 7 inches. The die had been heated before the water was turned on and a crack developed in the wall of the smaller hole, extending about 5 inches inward from the surface. To make this repair, the crack was V-d out to a depth of $\frac{3}{4}$ inch. Metal arc welding, using a heavy coated 25-20 stainless steel electrode, was employed to fill two thirds of the V. On this was laid a $\frac{1}{4}$-inch deposit with the atomic hydrogen torch, using an alloy filler rod of C...0.40; Si...1.05; Cr...5.0; V...1.10; Mo...1.35 percent.

The three small welds in *Fig.* 5 are for temporary bonding. The round block, or bed, of machine steel is 8 inches in diameter and $4\frac{1}{2}$ inches thick.

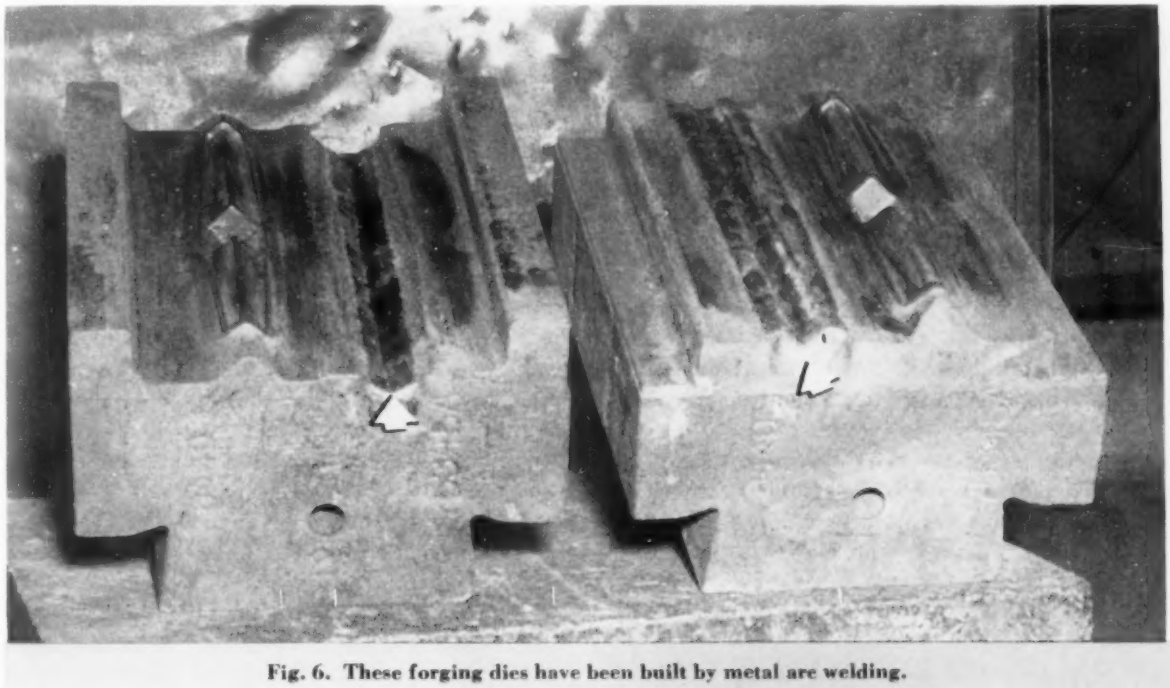


Fig. 6. These forging dies have been built by metal arc welding.

Fig. 7. To modify the die casting die shown here, a wide channel in the vertical face has been filled with a deposit of metal.

Into this is inserted the forming die which is 4⅞ inches OD, 2¾ inches ID and 3 inches deep. It was desired to fasten this assembly together tightly but not permanently. Three small craters ¼ inch deep were machined to straddle the junction of the die and block at equidistant points. A 3½-percent nickel steel filler rod was used for these welds because a hard weld was not wanted and it was desired to avoid annealing.

The forging dies in *Fig.* 6 are 14 inches long, 12 inches wide and 8 inches thick. They had become worn and an attempt to build them up by metal arc welding using a heavy coated stainless steel filler rod proved unsatisfactory. The old weld metal was cut out and the dies built up with atomic hydrogen arc. The filler rod used was an alloy containing C...0.45, Mn...0.80, Si...0.30, Cr...1.00, V...0.15 percent.

A change in design of the end product made it necessary to modify the die casting die in *Fig.* 7. Here a wide channel in the vertical face has been filled with a deposit from the rod used for the top layer of the weld in *Fig.* 4.

Such changes in details of technique as may be necessary over the wide range of compositions in tool and die steels are mostly based on differences in heat-treating characteristics. Those which are most susceptible to checking need higher preheat temperatures. With all of them care must be taken to avoid building up too much heat during welding, especially if long deposits are being made. High heat input leads to undue metallurgical disturbance and residual stresses. In the field of welding heat effects are critical, regardless of the size of the deposit.

Five Keys for Production Control

One of the men who should know about such things listed the five main steps necessary, in his opinion, for production control. Previous to his enumeration, though, W. W. Gilmore, president of the Micro Div. of Minneapolis-Honeywell Regulator Co., speaking before executives attending the recent American Management Association's nation conference, called production control a state of mind rather than an overabundance of routines, procedures and forms.

He explained his statement further by saying that this state of mind, starting with top management, means a "healthy respect for scheduled dates and care to see that dates are not set that can't be met. For this, industry needs just enough production control to do the job without frills. He went on to suggest that management eliminate excessive forms and procedures that do not help in the scheduled date arrangement.

The Freeport (Illinois) executive then continued with listing these steps in production control.

1. Enough raw material in the plant to govern production, based on the amount of flow time available for replacement of parts.

2. A set of books that tells accurately how many parts are available at all times to meet production requirements.

3. Enough parts on order and scheduled in to replace all inventories as used.

4. Departmental scheduling according to machines and personnel so that dates may be established as to when parts are needed in the next department.

5. Assembly scheduling on a man-hour-per-unit basis which permits shipping schedules to be met.

To make an effective production control system, according to Mr. Gilmore, the purchasing, production and sales departments all must cooperate. These three departments are not "three kingdoms which function separately and on their own whims. They are part of an over-all plan and must operate as a team."

DECIMAL DIMENSIONING Saves Time and Reduces Errors

By George E. Rowbotham

Manufacturing Engineering

Ford Motor Co., Dearborn, Mich.

THE USE OF FRACTIONS in dimensioning may eventually be discontinued completely as the simpler decimal system finds more and more converts in American industry. Decimal dimensioning offers the advantages of the metric system long advocated by many, without the disruptive work and expense that would be entailed in converting to the metric system.

The decimal system is successfully used on both engineering design drawings and manufacturing drawings of machinery, tools, gages, dies fixtures, and related items. The system simplifies the work of the product engineer, draftsman, checker, production engineer, tool and die maker, machine operator and inspector.

Adopted by Ford Motor Co. in 1932, the decimal system of dimensioning has also been accepted by Curtiss-Wright, many divisions of General Motors and numerous other organizations. The *SAE Aeronautical Drafting Manual* presents it as preferred practice.

Recently a subcommittee of the American Standards Association unanimously approved the decimal system to be submitted for consideration by the parent body. It is expected that the system will be presented as an American alternative standard. This action underlines the trend in industry toward acceptance of decimal dimensioning.

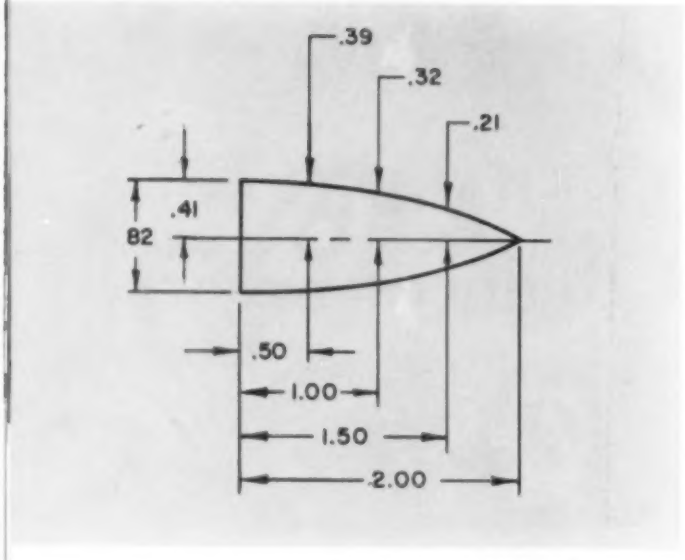
The primary advantage resulting from adoption of the decimal system of dimensioning is the simplification of arithmetic computations. In the decimal system, the inch is divided into tenths, hundredths, thousandths, etc., instead of unwieldy fractions like 1/8, 1/16, 1/32, or 1/64. Draftsmen and designers consider dimensions only in terms of decimals and develop designs accordingly, obviating cumbersome conversions.

In a 2-place decimal system, for instance, the second place decimal can be in even hundredth increments of an inch such as 0.04, 0.34 or 0.86, rather than odd hundredths like 0.03, 0.35, and 0.87, so that when divided by two, as from centerline to edge or to centerline of hole, the dimension that results will be a two-place decimal. Odd hundredths need be used only where required for design factors such as clearances and for dimensioning curved surfaces to obtain a smooth, uniform curve.

The greater simplicity of the decimal system for adding dimensions is comparatively illustrated in the accompanying tabulations. The first column shows a series of even two-place decimal dimensions; the second column lists a series of corresponding fractional dimensions. In the third column, fractions have been converted to decimal equivalents. Some additional advantages of the

Addition of Decimal and Fractional Dimensions

Two-Place Decimal System	Fractional System	Decimal Equivalents
.04	1 /32	.03125
.08	5 /64	.078125
.12	1 /8	.125
.58	37 /64	.578125
.56	9 /16	.5625
.34	11 /32	.34375
1.72	1 23 /32	1.718750



Dimensions can usually be established in even hundredths to simplify computations. Curved surfaces, however, may require odd hundredths also to assure smooth contours. For instance, when the symmetrical dimension involving a centerline is divided in two, the result is a two-place decimal.

decimal system are discussed in the following paragraphs.

Converting the readings of measuring tools—such as micrometers, vernier calipers, or height gages, which are graduated in decimal increments of an inch—becomes unnecessary. The need of constant reference to conversion charts is eliminated, reducing errors. Few draftsmen or engineers can letter the decimal equivalents of all fractions without time-wasting reference to conversion charts. When memory is depended upon for decimal equivalents the probability of error increases.

Definite values and uniform interpretation are assured. The question frequently arises concerning the number of decimal places that apply when a fractional dimension is given. For instance, should 7/16 be 0.4375, or 0.437, 0.438, or 0.44?

Eyestrain and dimensioning errors are reduced in the drafting room because of the increase in distance between the 1/64 graduations on the fractional scale and the 1/50 (.02) graduations on the decimal scale. The distance between the smallest graduation on the decimal scale is approximately 30 percent larger.

The dual system of dimensioning is eliminated. With the fractioning system, however, both decimals and fractions are used. With the decimal system it is easier to avoid overcrowding dimensions. Neater drawings result. Draftsmen can generally letter decimals such as 0.74 more neatly than fractions like 47/64.

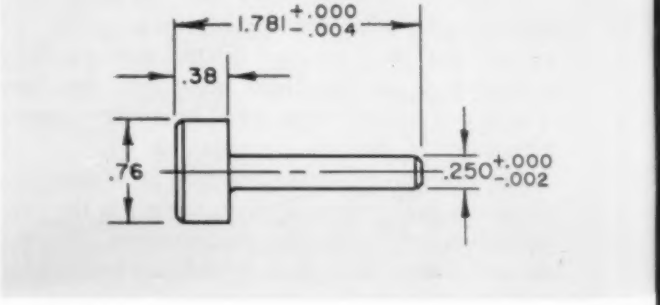
Decimals are easier to understand. Everyone is acquainted with its use in the American monetary system in which sums are expressed in units and decimal increments of units (dollars and cents) such as $5.76. A decimal dimension is expressed as 5.76. During World War II, it was observed that trainees, particularly woman, had far less difficulty in understanding the decimal system. This point may be confirmed by asking one's wife or secretary to divide 29/32 by 2, or 1/16 by 4.

In a survey conducted by an SAE committee in 1947, a test given to a group of engineering department employees revealed that it takes approximately five times longer to add fractions than decimals. The test was repeated later at a meeting of college professors substantiating the original observations. Assuming that an engineer, designer, checker or draftsman expends an average of approximately 10 percent of his work week in arithmetic computations involving dimensions, it has been estimated that four hours would be devoted to computations in a 40-hour week. By using the decimal system the 80 percent savings in computation time would amount to 3.20 hours per week. The survey further discovered that 47 organizations in the aeronautical industry were using decimal dimensioning. Considering only the engineering departments, it was assumed that, on an average, 200 people in each company were affected.

If the time saved for each of these 200 employees amounted to 3.20 hours each week, 640 hours were gained in each organization per week. Then, for the 47 companies, 30,080 hours are saved in the industry per week. Using this figure and an arbitrarily assumed average salary rate of $2.00 per hour, the yearly savings amounts to $3,128,320.

These figures represent only a small portion of the over-all savings in the industry that can be attributed to the decimal system. If it were possible to evaluate all gains resulting from use of the system, the savings could be increased a hundredfold.

Convenience of the decimal system of dimensioning is brought out in the sketch. Dimensions may be given in one-place, two-place or three-place decimals as required and tolerances or limits indicated accordingly.



Tooling Applications of Hard Facing Alloys

By L. V. LaRou

Chief Engineer, Wall Colmonoy Corp.
Detroit, Mich.

NEW DEVELOPMENTS in applying hard facing alloys are permitting tool engineers to make effective use of hard-faced alloy coatings on metal parts. These coatings provide wear and abrasion-resistant surfaces that outwear hardened steel from 5 to 25 times. Typical tool engineering applications include not only tools, dies, fixtures, arbors, mandrels, rests, centers and gages, but also such machine tool parts as cams, ways, spindles and pistons.

Hard-facing alloys can be applied easily to tools and machine parts in manufacturing plant machine repair or toolroom departments. A minimum capital outlay is required for the hard-facing equipment. The cost of material and labor for hard facing tools and parts is a minor consideration when compared to the cost savings that can be achieved by the long maintenance-free wear life that alloy coatings assure. Further, hard-faced alloy coatings can be simply and easily renewed, thus eliminating the costs of manufacturing new tools or parts.

The latest techniques for applying these hard surfaces avoid heat concentrations that might distort precision parts, permitting the application of the alloys to steels, stainless steels, copper, and some cast irons.

Either oxyacetylene or electric arc welding techniques or the new Sprayweld method can be used. Welding methods using these alloys in rod or electrode form are used on applications requiring heavy overlays or where parts are large or of a shape

Abstracted from paper 21T21-1, "Tooling Applications of Hard Facing Alloys," presented at the 21st ASTE Annual Meeting. Copies of the complete paper will be available from the Society Headquarters.

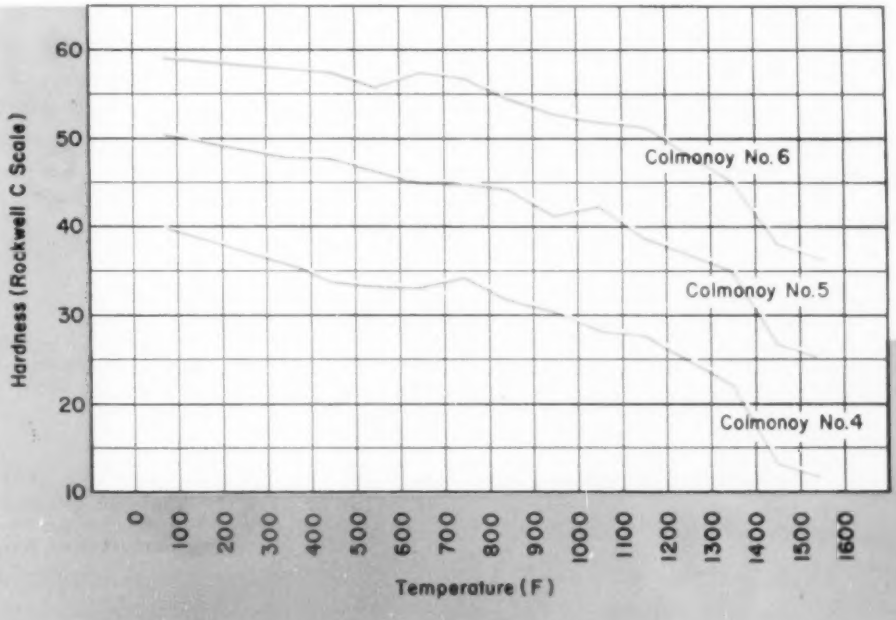
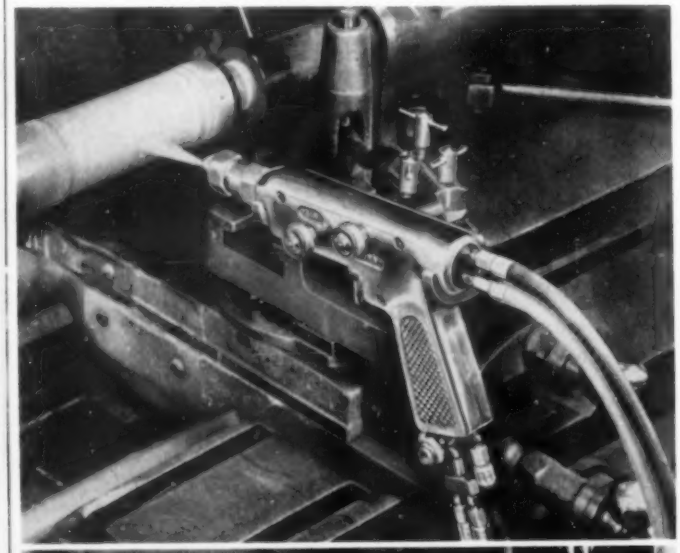


Fig. 1. Hardness of Colmonoy nickel-base alloys at elevated temperatures.

Table 1—Properties of Colmonoy Nickel Base Alloys

	Colmonoy No. 6	Colmonoy No. 5	Colmonoy No. 4
Approximate Analysis Percent	Ni 65 to 75 Cr 13 to 20 B 2.75 to 4.75 Fe | Si | C 10 max	Ni 71 to 81 Cr 10 to 17 B 2 to 4 Fe | Si | C 9 max	Ni 75 to 85 Cr 8 to 14 B 2 to 3 Fe | Si | C 8 max
Hardness Rockwell C	56-61	45-50	35-40
Specific Gravity	7.80	8.14	8.22
Melting Point	1900 F	1950 F	2025 F
Qualities:			
Abrasion resistance	Excellent	Very good	Good
Corrosion resistance	Excellent	Excellent	Excellent
Impact resistance	Good	Very good	Very good
Galling resistance	Excellent	Very good	Very good
Red hardness	Excellent	Excellent	Excellent
Weldability	Excellent	Excellent	Excellent
Machinability	Grind or Machine with carbide tool Nonmagnetic	Grind or Machine with carbide tool Nonmagnetic	Grind or Machine with carbide tool Nonmagnetic
Supplied as	Bare & coated rods 3/16", 1/4", 5/16", 3/8" diameter, Powder, Castings	Bare & coated rods 3/16", 1/4", 5/16", 3/8" diameter Powder, Castings	Bare & coated rods 3/16", 1/4", 5/16", 3/8" diameter, Powder, Castings
Tip Color	Red	Ivory	Black
Applied by	Oxyacetylene DC electric arc Spraywelding	Oxyacetylene DC electric arc Spraywelding	Oxyacetylene DC electric arc Spraywelding



that does not lend itself to Spraywelding. The latter method is adapted to parts where thickness of the hard-faced alloy surfaces need not exceed 0.060 inch.

Both methods produce hard surfaces that are fused to the base metal and provide a long-life nonporous coating that will not peel or crack off in severe applications such as those imposed in the tooling or machine tool field.

Properties of Hard Facing Alloys

Typical alloys for this application are made in forms permitting use of either oxyacetylene welding or Spraywelding techniques and are designated as Colmonoy alloys Nos. 4, 5, and 6. They are nickel-base alloys containing chromium and boron. They have hardnesses, TABLE 1, ranging from 35 to 61 Rockwell C scale. They all have good to excellent abrasion, corrosion, impact and galling resistance. They all have excellent red hardness and weldability. These alloy surfaces can be finished

Fig. 2. When the facing alloy is to be sprayed on the part, the gun is mounted on the lathe tool post and fed back and forth across the work.

Fig. 3. The part is left in the turning fixture for fusing the overlay to the base metal and rotated under an oxyacetylene flame.

either by grinding, or by machining with carbide.

The alloys listed in TABLE 1 all have high resistance to oxidation at elevated temperatures, excellent metal wetting properties which promote their affinity in the molten state to other metals, and what is known as a high plastic range. The No. 6 alloy in particular remains solid up to 1850 F; it then becomes plastic or mushy up to 2050 F. This wide plastic range permits the alloy to bond to various metals without flowing or losing their shape.

Fig. 1 shows Rockwell C hardness characteristics of Colmonoy nickel-base alloys at elevated temperatures. These alloys retain their hardness characteristics after repeated heating and cooling cycles throughout the ranges shown in the table.

Actually, hardness readings are not an accurate indication of the wear resistance of these alloys. They have an additional advantage of a low friction coefficient that reduces wear. In actual practice it has been found that these nickel-base alloys resist wear better than many other hard-facing alloys with higher Rockwell hardnesses.

The Sprayweld Process

The Sprayweld process, which has been developed to its current state of refinement since World War II, combines the advantages of welding and metalizing. The alloys are applied in powder form by a flame spraying process, becoming fused to the base metal by one of three surface heating processes. There are four steps in preparing a metal part for Spraywelding.

PREPARATION OF THE SURFACE: The surface to be spraywelded must have all plating, carburizing, nitriding or other surface treatment removed. Then the surface to be sprayed is undercut to a diameter that will provide the desired thickness of alloy after processing. The minimum depth of undercut is 0.005 inch greater than the depth determined by the amount of wear permitted in service. The minimum recommended undercut is 0.010 inch. The undercut should be blended out to the original diameter with a 30-degree chamfer. External corners to be Spraywelded should have a $\frac{1}{32}$-inch radius.

If the part has a Rockwell C hardness of less than 30, the area to be coated is next blasted with hardened angular steel No. 30 grit at a pressure from 90 to 100 psi before grit blasting. The grit blasted surface provides the required mechanical bond between the sprayed alloy overlay and the base metal during the spraying operation, thus preventing lifting or peeling of the overlay during the subsequent fusing operation. Instead of grit blasting, a fine threaded surface of from 60 to 80 threads per inch can be used if desired.

SPRAYING ON THE ALLOY OVERLAY: The grit blasted part is next chucked in a suitable engine lathe or turning fixture, *Fig.* 2, and rotated while the Spraywelder gun, mounted on the lathe tool post, is machine-fed back and forth across the part. The pistol is mounted so that the tip is about 5½ inches from the work. The amount of alloy thickness applied in the spraying operation is determined by the stock left for finishing and the shrinkage of the overlay during the subsequent fusing operation. Usually about 0.010 inch is left on a side for finish-

Fig. 4. Paddle-type plug gages with gaging surfaces wearproofed by Spray-welding.

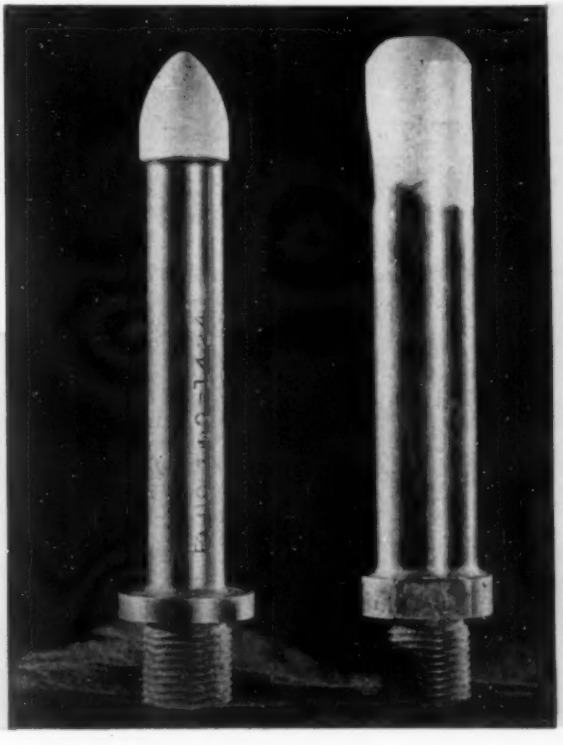


Fig. 5. Tube expanding mandrels which have produced 50,000 parts before requiring reprocessing.

ing. An allowance of about 20 percent of the total overlay thickness is made for shrinkage of the overlay. Thus, to calculate the total thickness of overlay to be sprayed on a side, add 0.010 inch to the finished depth of overlay and increase this total by 25 percent.

Fusing the Overlay to the Base Metal: The conventional method for fusing is to leave the part in the turning fixture, *Fig.* 3, and rotate it under an oxyacetylene flame. The flame is played on the base metal at the starting end until it reaches a dull red, after which the flame is applied at the edge of the sprayed deposit and moved along as rapidly as fusion progresses. A controlled atmosphere furnace or induction heating method can also be utilized. During the fusing operation, the alloy particles in the overlay melt to form a dense, hard, wear- and corrosion- resistant layer molecularly bonded to the base metal.

Finishing the Alloy Surface: The fused alloy surface can be finished to the specified dimension and surface finish either by turning with a carbide tool, or by grinding.

When machining alloy deposits with carbide-tipped tools, the grade of carbide recommended is either Carboloy 883 or Firthite HA. In general, low surface speeds are used to produce the desired finish and avoid tool wear and breakage.

When grinding the surfaces, a green or black silicon carbide wheel is recommended. It should have H to K hardness, 24 to 36 grit for roughing and 60 grit or finer for finishing. The grinding operation must be performed wet, if possible. Maximum grinding economy is achieved by taking light fast cuts. A roughly dressed wheel should be used for roughing and a medium dressed wheel should be used for finishing.

By the process described, a uniform nonporous deposit of any thickness up to 0.060 inch can be applied to steel, stainless steel, copper and some cast iron parts. Finishing time and costs are low because of minimum stock removal.

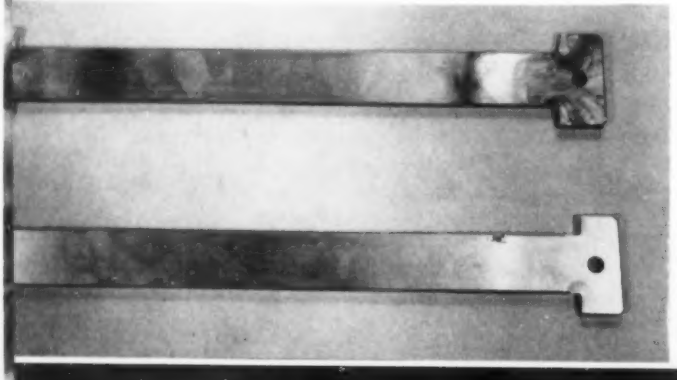
Various contours and shapes including flats and rounds can be processed. The operation is much faster than hand-welding operations, and distortion is held to a minimum.

Necessary Equipment for the Process

The coating or spraying unit consists of a wall or pedestal-mounted panel and a pistol. The panel supports the alloy powder hopper, carburetor, air regulator and air filter, and has a bracket that supports the pistol when it is not in use. In addition to the unit, oxygen and acetylene are required plus an air source capable of delivering 15 cfm of air at 60 psi minimum.

Hard-faced Gages and Tools

Hard-facing alloys prolong the life of expensive close tolerance parts such as plug gages, *Fig.* 4. These parts are well adapted by shape and size to the process. Many plug gages are now being wear-proofed in this manner. When hard-faced gages are worn, the alloy surface can be ground down and reprocessed to provide a gage as good as new.



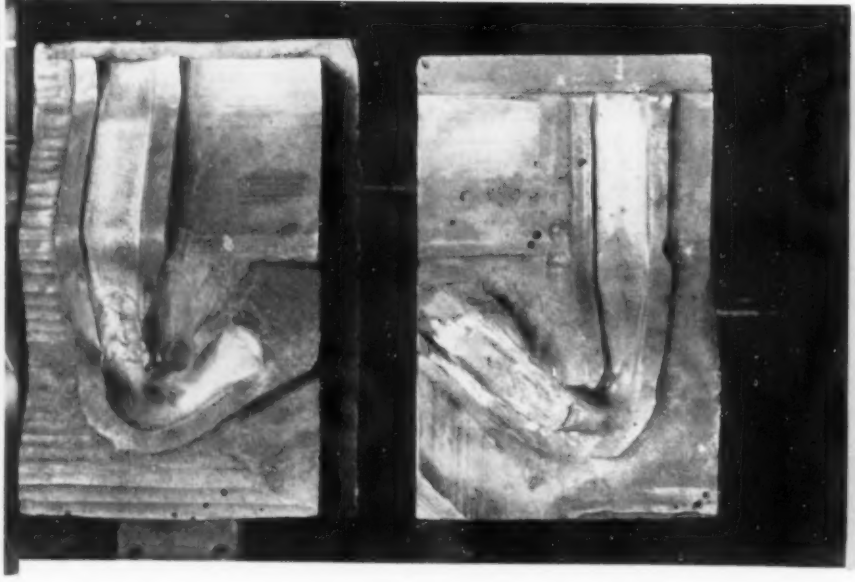


Fig. 6. Plate-type length gages with torch-welded hard-faced gaging surfaces.

Fig. 7. Finish forging die wear-proofed with a torch-welded nickel base hard facing alloy.

Other tool applications of the hard facing process include spring mandrels and arbors. The tube expanding mandrel shown in *Fig.* 5 was used to form stainless steel tubing in an aircraft manufacturing plant. It produced 50,000 parts before reprocessing as compared with 500 parts produced with a hardened steel mandrel.

Guide surfaces on broaches are another application where hard facing has prevented galling and assured part accuracy. Deep hole drills are another application in the same category.

Torch Welded Hard-Faced Gages, Tools and Dies

The shape of plate-type snap gages does not lend itself to Spraywelding. However, by using the oxy-acetylene welding method in conjunction with nickel-base rods, satisfactory hard-faced wear-proof coatings can be economically applied. Such gages are shown in *Fig.* 6. Lathe centers, forming rolls, centerless grinding work rests, and work guide rails are other typical tooling items that can be wear-proofed by torch welding hard-facing methods. Currently, centerless grinder work rests are being supplied in the form of castings so there is no necessity of providing welded hard-faced surfaces.

Cast center tips are also available in standard sizes. In large centers, hard facing techniques can also be used in connection with a low-carbon steel-base metal to avoid the necessity of making the entire center out of high-speed steel. Wherever high-speed steel is used for its wear resistant properties in large tooling items, considerable savings can result if hard facing methods are applied to less expensive base metals.

Forging and sheet metal dies are other tools worthy of hard facing consideration. The forging finishing die in *Fig.* 7 has had its useful life prolonged by torch-welded hard surfaces. The sheet metal draw die pressure ring in *Fig.* 8 has been prevented from galling and scoring by torch welding the edges and corners.

Machine Tool Parts

In view of high speeds and feeds at which modern machine tools are now operated, tool engineers can effect considerable cost savings if they pay close attention to machine parts that require maintenance. Wear-proofing of many such parts by hard facing methods can often reduce expensive maintenance charges. The Spraywelding technique, in particular, offers a low-cost simple method by providing wear-proof surfaces. The torch-welding method can be economically used in applications where heavier coatings are required.

Cams with irregular surfaces for screw machines can be wearproofed by torch welding with No. 6 alloy. Other machine tool parts such as hydraulic valves and die casting machine spindles can be Spraywelded to provide accurate long-life parts that will far outlast their hardened steel counterparts.

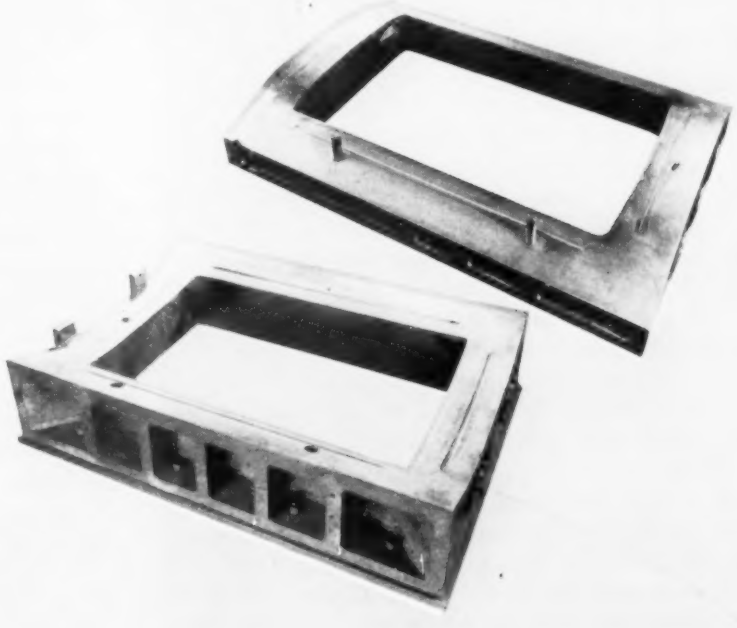


Fig. 8. The upper and lower sections of this sheet metal draw die pressure ring have been protected against galling and scoring by torch welding an alloy surface on the edges and corners.

Machinery Replacement

—how costs are determined

By Edward C. Varnum*

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In discussions of machine replacement the emphasis has been placed on the application of the theory to specific examples. This is natural since the practical aspect of the system is of interest to most everyone in management. Reference to the algebra of replacement theory is generally brief. For those interested in the derivation of the formulas, however, the following discussion of the theory which is gaining in popularity is presented.

This theory is advanced by the Machinery and Allied Products Institute which is a federation of over thirty trade associations in the industrial machinery and equipment field. Through the efforts of its research director, George Terborgh, and his mathematician, Dr. Eric Schiff, in cooperation with several officials of member companies, the Institute has set forth its method in a full-length book entitled *Dynamic Equipment Policy* (McGraw-Hill 1949) and in a condensed version, *MAPI Replacement Manual* (Machinery and Allied Products Institute 1950).

The notion of a constant operating inferiority gradient is fundamental in the MAPI theory. Operating inferiority, as the term implies, is a dollar value which describes the disadvantage of not owning new equipment. Operating inferiority gradient is the excess of one year's operating inferiority over that for the preceding year. This gradient is designated by g. Capital cost of the equipment under consideration is designated by c. The interest rate to be used is i, and n designates a number of years.

The first operating inferiority charge is g and it occurs at the end of the second year, as there is no operating inferiority during the first year. The present value of the first operating inferiority is $g(1 + i)^{-2}$. The present value of an amount of money due at a future date is the number of dollars which invested today will yield the prescribed amount at that date. The second operating inferiority charge is $2g$ which occurs at the end of the third year. The present value of the second operating inferiority is $2g(1 + i)^{-3}$. The present value of the third operating inferiority is $3g(1 + i)^{-4}$. Adding these present values of operating inferiorities for n years, a series results whose sum is denoted by V.

$$V = g(1+i)^{-2} + 2g(1+i)^{-3} + \ldots + (n-1)g(1+i)^{-n} \quad \ldots\ldots\ldots\ldots (1)$$

This series combines features of both the arithmetic progression and the geometric progression. By combining the methods customarily used to sum arithmetic and geometric progressions, a compact expression for V may be obtained as follows:

Multiply all terms of Equation 1 by $(1 + i)^{-1}$

$$(1+i)^{-1}V = g(1+i)^{-3} + 2g(1+i)^{-4} \ldots + (n-1)g(1+i)^{-n-1} \quad \ldots\ldots (2)$$

Subtracting Equation 2 from Equation 1 gives

$$V-(1+i)^{-1}V = g(1+i)^{-2} + g(1+i)^{-3} \ldots + g(1+i)^{-n} - (n-1)g(1+i)^{-n-1} \ldots \quad \ldots\ldots (3)$$

Except for the last term, the right-hand side of Equation 3 is a geometric progression whose first term is $g(1 + i)^{-2}$ and whose common ratio is

* Senior member ASTE Rockford Chapter

$(1 + i)^{-1}$. The sum of this geometric progression is found by the usual method and substituted in Equation 3 to obtain

$$V-(1+i)^{-1}V=\frac{g[(1+i)^{-n+1}-1]}{(1+i)^2[(1+i)^{-1}-1]}-(n-1)g(1+i)^{-n+1} \quad \ldots\ldots (4)$$

Solving Equation 4 for V and simplifying,

$$V=\frac{g-g(1+i)^{-n}(in+1)}{i^2} \quad \ldots\ldots (5)$$

This gives the present value of all operating inferiorities to and including the end of the nth year. Note that V is a function of g, i and n. The present value of the capital cost is, of course, c so that the combined present value of capital cost and operating inferiority is $c + V$.

Considering an annuity of n equal end-of-year payments whose present value is $c + V$, each equal payment of such an annuity will be called u and is termed "adverse average." By the customary annuity formulas, the value of u is

$$u=\frac{(c+V)\,i}{1-(1+i)^{-n}} \quad \ldots\ldots (6)$$

A typical adverse average, composed of amortization cost and inferiority charge, is plotted in *Fig.* 1. Combining Equations 5 and 6 and simplifying, an expression for u as a function of c, g, i and n is obtained:

$$u=\frac{ci^2+g-g(1+i)^{-n}\,(in+1)}{i\,[1-(1+i)^{-n}]} \quad \ldots\ldots (7)$$

For fixed values of c, g, and i, u could be plotted against n. Such a curve would be high for $n = 1$ and decrease as n increases due to the lower amortization payments on the capital cost. As the effects of operating inferiorities become more and more pronounced, however, the adverse average curve will cease its decline and start increasing. The value of u at its lowest point is called the "adverse minimum" and is denoted by u_{min}. The value of n at which u is a minimum is called the "service life" and is denoted by N.

To find the minimum value of u, the derivative of u with respect to n is equated to zero to give an equation which when combined with Equation 7, yields a definite expression for u_{min} in terms of c, i, and N. The highlights of the details of this procedure are as follows:

$$\frac{du}{dn}=\frac{i\,[1-(1+i)^{-n}]\,[g(1+i)^{-n}\log(1+i)\,(in+1)-ig(1+i)^{-n}]}{i^2[1-(1-i)^{-n}]^2}$$

$$-\frac{[ci^2+g-g(1+i)^{-n}\,(in+1)]\,i(1+i)^{-n}\log(1+i)}{i^2[1-(1+i)^{-n}]^2} \quad \ldots\ldots (8)$$

This step is the only instance in which any mathematics higher than algebra has been required. At a later stage, series expansions will again be used for approximations but, with these two exceptions, the complete development of the theory is an application of algebraic manipulations to the quantities c, g, i, and n derived as indicated.

The next step is to set the right-hand side of Equation 8 equal to zero. This will determine the value of n which is called N. Replacing n by N in the resulting Equations gives

$$g\log(1+i)\,(iN+i)-ig-g(1+i)^{-N}\log(1+i)\,(iN+1)$$
$$-ig(1+i)^{-N}-ci^2\log(1+i)-g\log(1+i)$$
$$+g(1+i)^{-N}\,(iN+1)\log(1+i)=0 \quad \ldots\ldots (9)$$

By simplifying the coefficients of g the above equation can be reduced to

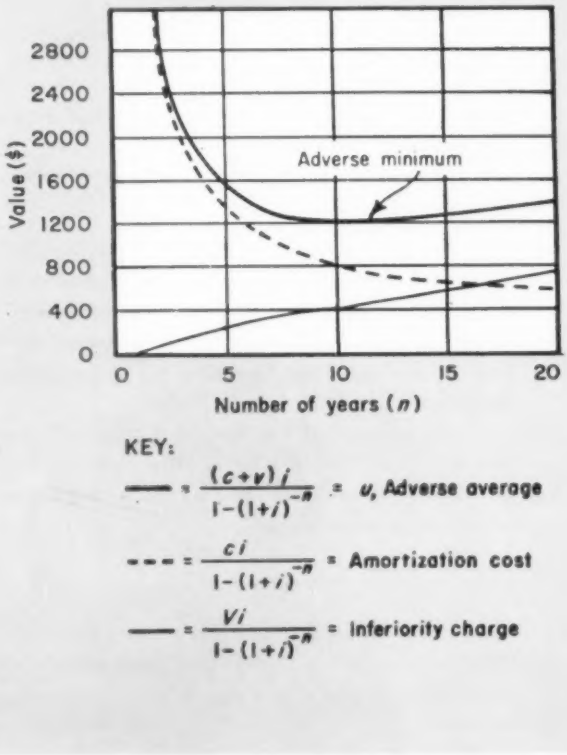
$$ci\log(1+i)=g\,[N\log(1+i)-1+(1+i)^{-N}] \quad \ldots\ldots (10)$$

Considering Equations 7 and 10, it is possible to eliminate c between them by solving Equation 10 for c and substituting the result for c into Equation 7 to find the minimum value of u:

$$u_{min}=g\left[N-\frac{i-\log(1+i)}{i\log(1+i)}\right] \quad \ldots\ldots (11)$$

or, it is possible to eliminate g between Equations 7 and 10 by solving Equation 10 for g and substituting into Equation 7 to obtain the adverse minimum as a function of capital cost, service life, and interest rate, as follows:

Fig. 1. Graph of adverse average as a function of number of years.



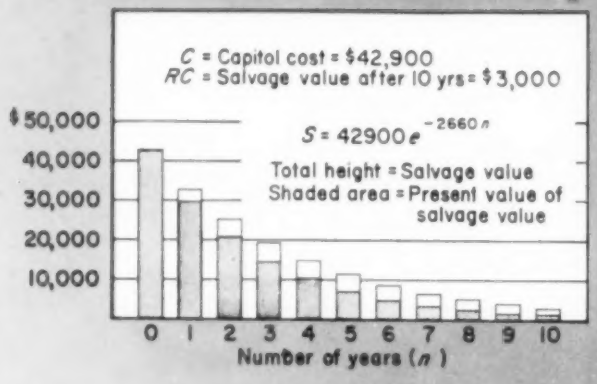


Fig. 2. Salvage values and present value of salvage values. Using the exponential decay curve for salvage value from Equation 20, the value of m is calculated for $S = 3000$, $c = 42900$ and $n = 10$. Corresponding values of S are calculated for each year and their present values are found by multiplying by $(1.1)^{-n}$.

$$u_{min} = c\left[N\frac{-i-\log(1+i)}{1\ \log(1+i)}\right] \times \left[\frac{i\log(1+i)}{N\log(1+i)-1+(1+i)^{-N}}\right] \quad \ldots\ (12)$$

By employing an approximation

$$\log(1+i) = i \quad \ldots\ (13)$$

the above equations reduce to fundamental equation of the MAPI theory:

$$u_{min} = gN \quad \ldots\ (14)$$

$$u_{min} = \frac{cNi^2}{iN-1+(1+i)^{-N}} \quad \ldots\ (15)$$

For those who are not content with the approximation, series expansions may be used for log $(1 + i)$ and for $(1 + i)^{-N}$. The expansions are

$$\log(1+i) = i-\frac{i^2}{2}+\frac{i^3}{3}-\frac{i^4}{4}+ \quad \ldots\ (16)$$

$$(1+i)^{-N} = 1-Ni+\frac{N(N+1)}{2}i^2-\frac{N(N+1)(N+2)}{6} \times i^3+\ldots \quad \ldots\ (17)$$

Substituting these into Equation 12 and rearranging

$$u_{min} = c\left[\frac{2N-1}{N^2}+\frac{2N^2+2N-1}{3N^2}i+i^2F(N)\right] \quad \ldots\ (18)$$

The third term in the bracket in Equation 18 indicates that i^2 is multiplied by some function of N. The product can reasonably be neglected as i^2 is a small number. Note also that approximation (13) can be derived from Equation 16 by neglecting i^2 and higher powers of i.

The coefficient of i in the third term in Equation 18 is $(2N^2+2N-1)/3N^2$. This fraction approaches 2/3 as N becomes large, so that Equation 18 can be approximated by

$$u_{min} = c\left[\frac{2N-1}{N^2}+\frac{i}{1.5}\right] \quad \ldots\ (19)$$

The approximate formula given by MAPI replaces the 1.5 in Equation 19 by 1.4. This has the effect of slightly raising the value, which is appropriate because $(2N^2 + 2N - 1)/3N^2$ is slightly more than 2/3 at all times. In actual fact the approximation goes from too low to too high as N goes from 13 years to 14 years.

Salvage Value: The preceding calculations are based on the assumption that the challenger or proposed new equipment is to have no salvage value. To calculate the effect of a salvage value on the adverse minimum, determine the uniform annual equivalent of the salvage value, subtract it from the uniform annual equivalent previously determined and continue as before to find the minimum point on the uniform annual equivalent curve. The highlights of such a procedure are as follows:

Assume a salvage value which decreases exponentially according to the following relationship.

$$S = sce^{-mn} \quad \ldots\ (20)$$

where the symbols have the following definitions:

S = salvage value at end on n years
s = salvage value factor
c = capital cost
m = exponential coefficient corresponding to the absolute value of the slope of the salvage value curve on semi-logarithmic paper.

The present value of S is given by $sc\ (1 + i)^{-n} \times e^{-mn}$ and its annual average will be

$$\frac{isc\ (1+i)^{-n}e^{-mn}}{1-(1+i)^{-n}}$$

The uniform annual equivalent for the salvage case will be

$$u = \frac{ci^2+g-g(1+i)^{-n}\ (in+1)-i^2\,sc\,(1+i)^{-n}e^{-mn}}{i\,[1-(1+i)^{-n}]} \quad \ldots\ (21)$$

After differentiating Equation 21 with respect to n, setting du/dn = O and simplifying,

$$ci\ \log(1+i) = g\,[n\ \log(1+i)-1+(1+i)^{-n}] + isce^{-mn}[\log(1+i)+m-m(1+i)^{-n}] \quad \ldots\ (21a)$$

Let N be the value of n for which the foregoing

equation is satisfied. The value of u_{min} will then be obtained by letting n equal N. With these substitutions made, elimination of g between the two equations gives

$$u_{min} = \left[N + \frac{\log(1+i) - i}{i \log(1+i)} \right] \times \left[\frac{ci \log(1+i) - isce^{-mN}[\log(1+i) + m - m(1+i)^{-N}]}{N \log(1+i) - 1 + (1+i)^{-N}} \right] + \frac{isce^{-mN}[m + \log(1+i)]}{\log(1+i)} \quad \ldots\ldots (22)$$

This expression for the adverse minimum of the challenger may be simplified by the same approximations used in the no-salvage case.

Moreover, letting

$$R = se^{-mN} \quad \ldots\ldots (23)$$

where R is the ratio of the salvage value at the end of the service life to the capital cost. With unity value for s, mN can be evaluated as the natural logarithm of the reciprocal of R. Making use of another notational convenience, namely, letting $p = (1+i)^{-N}$, Equation 22 can be mathematically reduced to the MAPI formula:

$$u_{min} = c \left[\frac{Ni(i + Rpm) - R(1+m)(1-p)}{iN + p - 1} \right] \ldots\ldots (24)$$

where

c = capital cost

N = service life

R = ratio of terminal salvage value to capital cost

i = interest rate

$m = \frac{1}{N} \log_e \left(\frac{1}{R} \right) = \frac{2.30259}{N} \log_{10} \left(\frac{1}{R} \right)$

$p = (1+i)^{-N}$ = present value factor for N years at interest rate i

Use of Formula: To use the formula for the adverse minimum of the challenger, the proper numerical values of c, N, R, and i are determined. From these values, m can be found from a logarithm table and p can be found in actuarial tables, or computed if necessary. The numerical values of c, N, R, i, m and p are then substituted into the proper equation for u_{min} and its value is calculated.

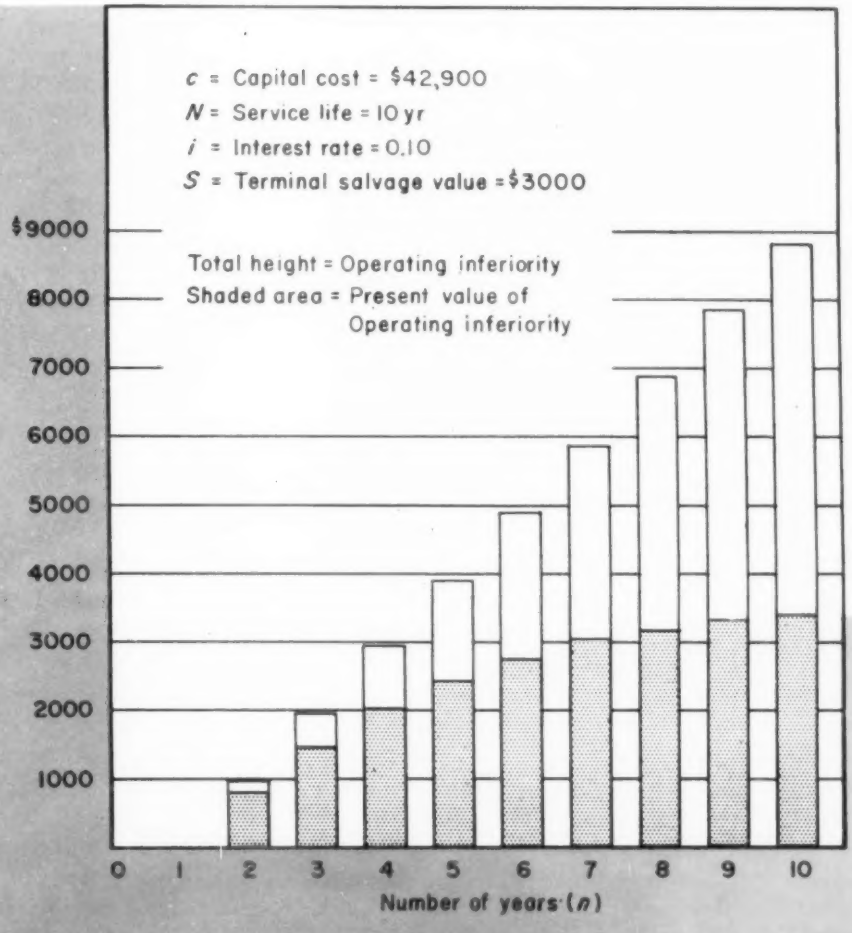


Fig. 3. Operating inferiorities and present value of operating inferiorities. By use of Equation 21*a*, *g* = $978.12, which is the operating inferiority for the second year as well as the operating inferiority gradient. The operating inferiority for the n^{th} year is (*n*-1) multiplied by $978.12 and its present value is $(1.1)^{-n}$ multiplied by the operating inferiority.

This calculation for u_{min} is, of course, unnecessarily tedious to perform for each replacement analysis and, therefore, for the value of i used in a given plant a numerical chart prepared once and for all for practical values of N and R can be used. For a value of $i = .10$, MAPI has prepared a graph based on Equation 24 which is given in the *MAPI Replacement Manual* and is also reproduced in THE TOOL ENGINEER for January 1953 by which adverse minimum can be readily determined by one simple addition and one multiplication.

Numerical Example: In the January 1953 issue of THE TOOL ENGINEER, Robert S. Collier gave an illustration of a challenger consisting of "three special 1-18 Millers for Milling Cast Iron Laps" having an installed cost of $42,900, a service life of 10 years, and an estimated salvage value of $3000. Furthermore, an interest rate of 10 percent was used in the example. In our notation, this information is described as follows:

$$C = 42900;\ N = 10;\ RC = 3000;\ i = 0.10$$

With these values known, R, m, and p can be computed.

$$R = \frac{3000}{42900} = 0.0699;$$

$$m = \frac{2.30259}{10} \log_{10} \frac{42900}{3000} = 0.2660$$

$p = (1.1)^{-10} = 0.385543$ (from present value tables or by successive multiplication.

Relation of salvage values for each year and their present values are shown in *Fig.* 2. We may now use values for C, N, R, i, m and p in the precise Equation 22 with log (1.1) = 2.30259 $\log_{10}$ 1.1 = 0.0953

$$u_{min} = \left[10 - \frac{.0953 - .1}{(.1)\ (.0953)}\right]$$

$$\left[\frac{42900(.1)(.0953) - (.1)(3000)[.0953 + .2660 - (.2660)(.3855)]}{10(.0953) - 1 + .3855}\right]$$

$$+ \frac{(.1)\ (3000)\ (.2660 + .0953)}{.0953}$$

$$= \$10{,}439$$

Operating inferiorities for each year and their present values are shown in *Fig.* 3.

To simplify calculations, Equation 24 may be used for $C = 42900$, $N = 10$, $i = .10$, $R = .0699$, $m = .2660$, $p = .3855$ as follows:

$$u_{min} = 42900 \times$$

$$\frac{10(.1)\ [.1 + .0699(.3855)\ (.2660)] - .0699(.1 + .2660)\ (1 - .3855)}{.1(10) + .3855 - 1}$$

$$= 42900\ (.2373) = \$10{,}180 \quad \ldots\ldots\ldots\ldots\ldots\ldots (25)$$

In the January article, the foregoing example was solved by means of the chart on p. 71 of the *MAPI Replacement Manual* which was read to give 14 percent for a salvage value ratio of 7 percent and a service life of ten years. By adding 10 percent to the chart 14 percent, a factor of 24 percent was obtained. This result compares with the 0.2373 factor in Equation 25. The chart thus gives 0.24 × 42900 or $10,290 as the challenger's adverse minimum. The agreement amongst all three values of the adverse minimum, i.e., $10,439 from Equation 22, $10,180 from Equation 24, and $10,290 from the MAPI chart is close enough for practical use. In the example cited, the adverse minimum of the defender was $16,550 so that any one of the three results for challenger adverse minimum would give clear indication that replacement is necessary.

Economy Through Layout

AN EXAMPLE of what a company can realize is concretely demonstrated at the Torrance plant of the Douglas Aircraft Co. Substantial savings in construction costs and plant floor space will be accomplished by improved foundation designing in the erection of eleven drop hammers. Prime departure from customary design in this installation of what may be industry's longest continuous line of adjacent air-powered spring suspended drop hammers, is the absence of division walls between the sub-floor inertia blocks.

The Chambersberg Cecostamp hammers, which will form sheet metal aircraft parts 24 x 30 in. in size up to 60 x 96 in., weigh up to 180,000 lb and will form an unbroken production line 181 ft long. Each hammer, with its anvil and base, will be seated at floor level on a poured concrete inertia block occupying a pit approximately 12 ft deep. The blocks will weigh up to 150 tons and will be supported by a network of steel beams.

Bearing the weight of each hammer and foundation will be a system of specially designed spring units capable of absorbing maximum impacts of up to 187,000 lb. These are designed to absorb both noise and vibration. A maximum depression of $\frac{5}{16}$ in. under full impact of the hammer is planned for the spring.

Designer of the installation facilities was C. V. Thomas while MacIsaac and Merke Co. are contractors for the operation.

Elements of Electroplating

By Robert T. Kimmel

IN RECENT YEARS a variety of uses in many new fields has been found for the electroplating process. As each new use is developed, the need for more exact knowledge has led to extended research on both the principles of electroplating and the control of the processes and products. The emphasis, however, has been not so much on the development and application of new methods, but rather on more efficient application of existing methods and knowledge.

Electroplating is the deposition of a thin, uniform coating of metal on a basis metal of essentially different composition by electrolytic means. When a direct current of sufficient potential is applied to the water solution of a metallic salt, current passes through the solution and a chemical change occurs at each electrode. At the negative electrode or cathode, there is an excess of electrons supplied by the direct current power source. The electrons at the cathode neutralize the positively charged metallic ions that migrate to it and convert the dissolved metal to the metallic, solid state characteristic of the common metals. At the positive electrode or anode an equivalent amount of metal goes into solution to replace the amount plated out at the cathode.

As the process continues, the number of metallic ions in the solution surrounding the cathode de-

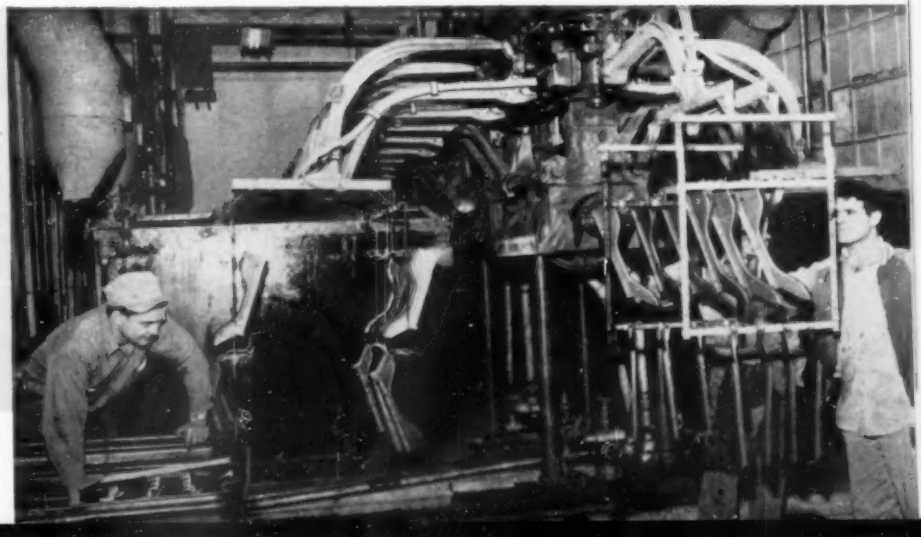
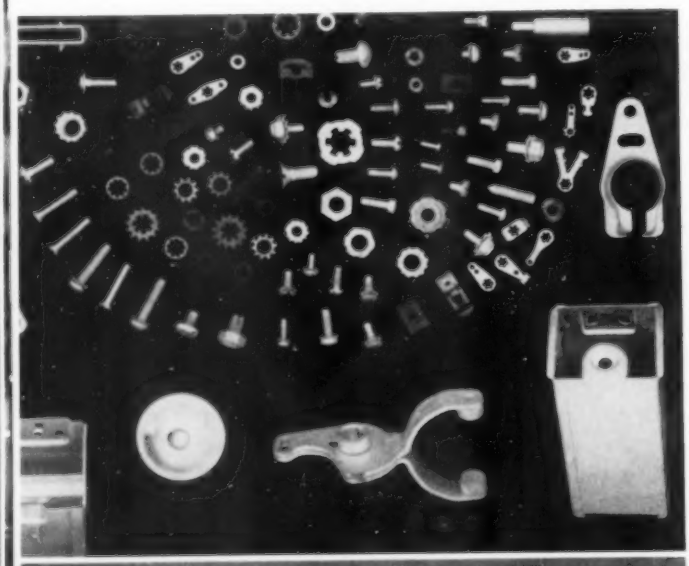
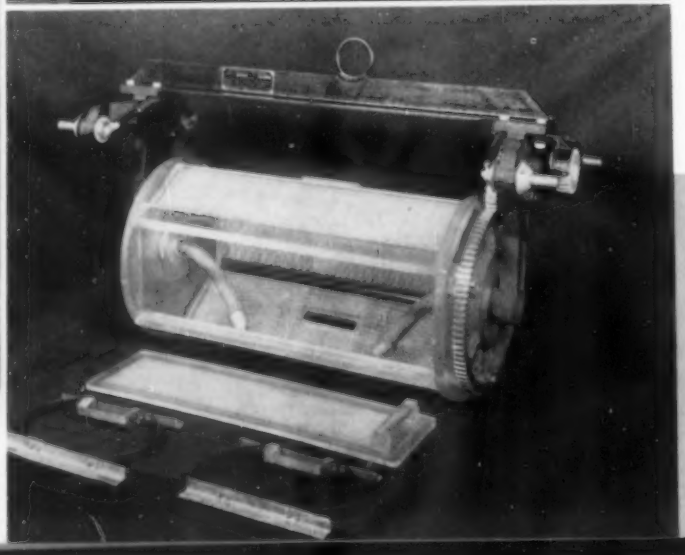


Fig. 1. Full automatic double row zinc plating machine. The two racks are 42 inches long, 22 inches wide, and 14 inches thick per carrier arm.

creases and what is known as a cathode film is formed. Gradually metallic ions from the surrounding solution diffuse into the film. It is easily seen that agitation of the solution will speed up this diffusion and provide a more uniform plating rate.

An important consideration in the plating process is the degree of pH or hydrogen ion concentration. Hydrogen ions are present in all aqueous solutions. Addition of an acid increases this concentration while an alkali increases the number of hydroxyl ions. Since the hydrogen ions are positively charged, they migrate to the cathode, where they may be discharged to form hydrogen gas. The cathode efficiency depends principally upon what proportions of the current are used, respectively, in depositing metal and hydrogen. Because this efficiency is partly determined by the concentration of hydrogen ions, it is important to know and control these concentrations, especially when the baths are nearly neutral such as those of nickel.





Surface Control

The metal coating deposited on the basis metal by the electroplating method is a crystallized form of the coating metal and usually forms in crystals of medium size. The size of these crystals is subject to control by varying several conditions during the process. The smaller the crystals are, the higher the luster and hardness of the coating. It is also smoother and stronger but less ductile than the coarse-grained deposits.

An operator can change the structure of deposits by altering the bath composition and by changing the conditions of deposition. The three principal changes which can be made in the operation of a bath are in current density, in the method or degree of agitation, and in the temperature.

The rate of production from a unit can be increased by increasing the current density. Higher currents also produce harder coatings, the thickness of which is governed by the amount of exposure time or the current density. In this respect, it is important that the current density does not exceed the limiting value, since rough or spongy deposits will result. Agitation of the solution causes a more even diffusion of the metal ions, particularly in the region called the cathode film. Agitation also sweeps away gas bubbles which may cause pits on the plating. It is desirable, too, because it mixes the solution and prevents stratification of heavier solution near the bottom of the tank.

Higher temperatures usually produce a softer coating which results from the increase in grain size. Heated solutions are used because the increased temperature permits the use of higher current densities since the mobility of the ions is increased. There is also less absorption of hydrogen in the deposits and less stress and tendency toward cracking.

Equipment

Direct current is necessary for all electroplating operations. Since the weight of the metal plated in a given time is roughly proportional to the current, the size of the equipment to supply the required current will depend on the area of the work to be plated

Fig. 2. (Top) A representative sampling of some of the many parts that have been successfully plated in a barrel processing machine.

Fig. 3. (Left) Lucite cylinders have, to a great extent, replaced those made of more conventional materials. They can be subjected to temperatures as high as 180 F.

at any given time. For most still plating, the current is available at 6 volts but is actually used at 2 or 4 volts across the tank. Barrel plating ordinarily requires up to 12 volts because of the greater resistance between the work and the anodes. A rule of thumb that can be used is that 100 amperes at 6 volts usually requires 1 hp. The power required can be supplied by either a d-c generator or a d-c rectifier.

Motor-generator sets are usually more expensive than the rectifiers of equal capacity. They need separate controls such as instrument panels and starters. They are also larger, heavier and less portable. But they are more rugged and less subject to failure from overloads, excessive temperature rise, dirty and corrosive atmospheres. Since there is a variety of operating conditions and demands, these factors must be evaluated carefully so that the correct equipment is purchased for installation in the plating room. When the requirements have been determined, information from a reputable manufacturer will aid in ordering the motor-generator.

In many applications it is more advantageous to use a rectifier. These units are becoming more widely used each year as further improvements are made in their design which suits them for particular operations. The rectifier is a device which offers very low resistance to current flowing in one direction, but which is virtually nonconducting in the opposite direction. When connected into a proper circuit, a series of pulses of current flows through the load in one direction. These pulses can be smoothed by adding the necessary elements to the circuit.

Fundamentally, a rectifier for plating purposes consists of two parts: a transformer which will step down the available alternating current to the desired voltage level, and a set of rectifier plates. These elements, of course, will be supplemented by switches, meters, voltage regulators, cooling equipment and protective devices. As in the selection of a motor-generator, consultation with the manufacturer will be invaluable in selecting the proper rectifier for a particular installation. In addition, some attention must be given to voltage regulators, conductors, contacts, rheostats, and electrical equipment for measuring current and voltage. These accessories are important since constant voltage is one of the prime requirements for the electroplating process.

Plating Racks

Racks for production plating are a special tooling problem to be solved only after all of the variables involved have been studied. Some of these are the size of the object, its shape, the portion to be plated, and the type of tip arrangement which will hold the article in correct relation to the anodes, provide the necessary electrical contact, provide adequate drainage, prevent solution carryover, and provide quick and easy racking and unracking, *Fig.* 1.

For uniform plating, articles on the racks should be equidistant from the anodes, because the rate of deposition varies with the distance from the anode. Maximum utilization of racks and other plating facilities requires that the greatest possible number of articles be held on a rack, yet sufficient spacing

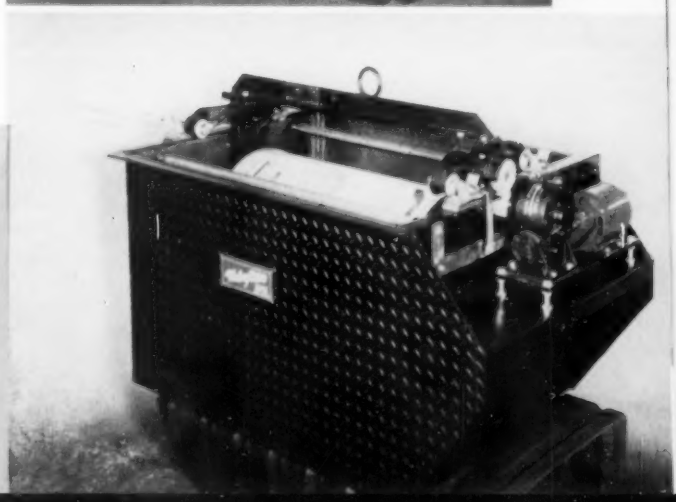


Fig. 4. (Top) Loading stands provide a degree of automation for the plating line when handling small parts in bulk.

Fig. 5. (Right) Plating barrels such as this one still carry the bulk of electroplating work.

must be provided between articles. Recesses and other hard-to-reach surfaces require the use of auxiliary anodes when the conventional setup will not produce a satisfactory deposit.

The tips that hold the articles and provide electrical contact are of utmost importance for efficient racks. They must afford fast racking and unracking, as well as hold the articles in correct position for uniform plating, good drainage and effective gas elimination.

Generally, the bottom of the lowest article on the rack should be six inches above the bottom of the tank, or five inches above any obstructions in the tank. The top of the highest article should be at least 1½ inches below the solution level for still plating and 2½ inches when the solution is agitated. The size of the frame members will be determined by the load to be carried.

Tanks

Tanks to contain the plating solution can be made from a number of materials, depending on the corrosive properties of the bath, the load to be supported, and the cost. In many cases, a lining is provided for special properties which it may possess. Most tanks are made from welded low-carbon steel with suitable linings when necessary. In the past, wood tanks were numerous, but are not now widely made. Hot alkaline cleaners can be contained in unlined tanks since rust is not a problem with these solutions.

Rubber-lined tanks are satisfactory for handling most inorganic acids except strong oxidizing agents. Higher temperatures will shorten the expected life of these linings. The general purpose rubber lining is of soft rubber which is resistant to ordinary acids or combinations of corrosion and abrasion. Hard rubber linings are used for severe corrosion where soft rubber is not satisfactory, but they will not withstand the effects of temperature change, impact, shock or abuse. A combination of the two kinds of rubber is sometimes employed to obtain the chemical resistance of hard rubber and the advantages of the soft rubber.

The chemical resistance of vinyl resins makes them very useful for lining tanks and other equipment. Vinyl-resin linings will successfully handle strong oxiding acids that cannot be handled in rubber. These linings can be used for handling corrosive chemicals and for protecting expensive plating solutions from contamination. They will also prevent electrolytic action on steel tanks. Since these resins are thermoplastic materials and at temperatures above 150 F become soft, they should not be used at higher temperatures unless protected by a brick sheathing which will afford thermal and physical protection.

Tile and brick linings installed with acid-proof cement over a suitable membrane are suitable for handling any type of chemical at any temperature. The sheet applied to the steel tank sides protects them from any corrosive action which might occur if there were a rupture in the cement between the bricks or tile. The tile and brick also act as excellent electrical insulators.

Lead is only slightly attacked by most acids and has been used extensively for tank linings. It can easily be formed into sheets for installing in the tanks. Special alloys of lead with tin, antimony and tellurium improve the chemical resistance and physical properties of lead.

Chemical stoneware tanks are useful when complete corrosion resistance, freedom from contamina-

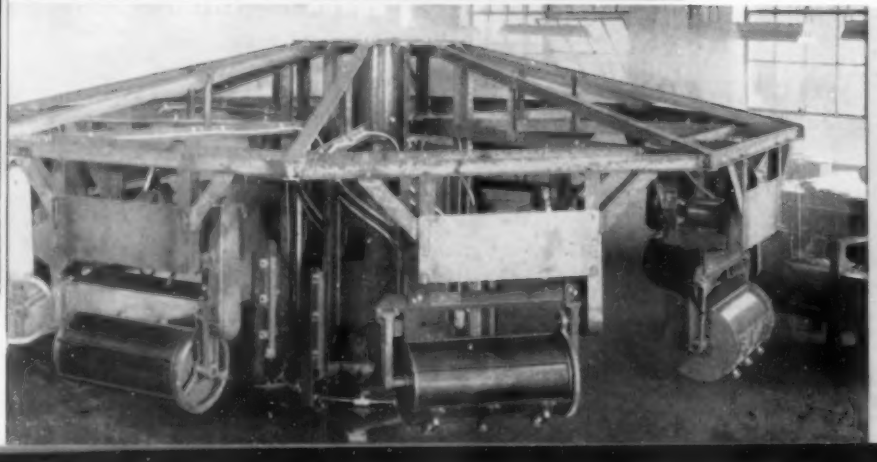


Fig. 6. This single row full automatic plating machine is noted for its economy of operation.

Fig. 7. The rotary automatic machine can handle heavy loads which are large and cumbersome.

tion and electrical insulation are required. One of the chief disadvantages of this type of tank is its susceptibility to breakage. This is more than offset, however, by the wide range of baths that can be handled.

Plastic tanks can be manufactured from various resins for different purposes. These are usually designed for some special use, and it is wise to consult the fabricator so that the correct materials can be selected for the project. Plastic tanks are less fragile than glass or ceramic tanks, and the outsides are not affected by corrosive fumes and liquids.

Glass is also an excellent material for tank linings. It should be used as a lining rather than for the tank itself because of the breakage factor. It is impervious to most acids and compounds, with the exception of hot caustics and solutions containing fluorine. Small glass tanks can be used without the outer steel or wood covering. The two main advantages of glass are that it is transparent and is easily cleaned.

Accessories

When the parts to be plated are small and can be handled in bulk, *Fig.* 2, they are usually loaded in a basket and tumbled so that all parts of the surfaces are exposed for even deposition. These baskets or cylinders are made from various materials, but lucite is by far the most widely used. The cylinder shown in *Fig.* 3 is formed from a single sheet of lucite and is mortised and cemented into the cylinder heads. It can be subjected to temperatures as high as 180 F under a 150-lb load. Other cylinders are made from bakelite for plating in common nickel, high chloride nickel, and acid copper. Hard rubber cylinders are suitable for cadmium, zinc, brass, etc. Those made from melamine are able to withstand hot cyanide solutions, hot stannates, and both mild acids and alkalies.

In connection with these cylinders, loading stands are frequently installed for loading and unloading the small parts to be plated, *Fig.* 4.

Automatic Plating Machines

The majority of plating installations in use today are of the barrel type, *Fig.* 5, and use the equipment described. However, research and development by some of the larger manufacturers of plating equipment have led to the introduction of automatic plating machines. These are of several different types. The equipment is still the same in principle, but has been adapted so that the racks can be carried by conveyors from one tank to another, these tanks having been assembled in a compact unit.

One of the major factors to be considered in selecting full automatic equipment is the racks. Their size will determine the operating characteristics of the machine, which will in turn affect the economy of the operation and the amount of production. Other items to be considered when ordering automatic equipment and racks, are the number of pieces to be handled per rack, the number of racks per hour for the desired production, and the finish to be produced.

The several types of automatic plating machines are the straight line, the return type, *Fig.* 6, and the rotary type, *Fig.* 7. Some of the features and limitations of each type are given in TABLE 1. The straightline machine is loaded at one end and unloaded at the other. In the return-type machine, the loading and unloading stations are both located at one end of the machine. The racks in both of these machines travel in a straight line. The circular or rotary equipment is described by its name. The straight-line and full automatic machines can also be double or single-line.

Table 1—Comparison of Automatic Plating Machines*

	Straight Line	Return Type	Rotary
Floor space	Very good	Good	Poor
Rack size	Large	Medium	Very large
Rack weight loaded	Heavy	Medium	Very heavy
Instal. cost & time	Greatest	Low	Low
Maintenance cost	Low	Low	Very low
Head room	Very high	Low	High
Machine accessibility	Very good	Fair	Good
Anode accessibility	Fair	Good	Good
Load & unload points	Separate	Same	Same
Rows of racks	1-2-3-4	1-2	1-2-3-4
Ventilation	Fair	Good	Very good

*Data from *Metal Finishing Guidebook Directory*

A principal feature of the single-row machine is its economy of operation, requiring in most cases only one man, and its adaptability to the single conveyor system used in most plants. The single row machine provides easier servicing, maintenance, ventilation, and solution control. It is usually from 7 to 10 feet wide.

The machine shown in *Fig.* 6 is a single-row, chainless, full automatic plating machine which is hydraulically driven. Operation of the machine is controlled by adjustment of the hydraulic valves. The work carriers ride directly on a one-piece cathode rail which acts as a support and conductor. When transfers are required, a section of the rail is hydraulically lifted, raising the work from the tank, the work carrier is moved by the hydraulic

pusher mechanism, and the work then lowered into the next tank. The three movements can be controlled separately at different speeds.

Double-row full automatic machines, *Figs.* 8 and 9, are similar to the single-row machines in construction. Production is doubled without a proportionate increase in floor space occupied. They are especially adapted to plant locations where length must be held to a minimum. The necessary extra length of the carrier rail turns, however, makes it necessary that these machines be built to greater width to accommodate the two rows of carriers.

The rotary full automatic machine shown in *Fig.* 7 is a large capacity machine with an hydraulic drive for jobs in which the rate of production is not a major factor, and where parts to be plated are large and cumbersome, such as airplane propeller blades. It is used in such operations as pickling, carburizing, heat treating, etc.

While more headroom and floor space are required by this type, this is compensated for by the extremely heavy loads and large racks this machine can handle. It has few parts and is easy to maintain. It is constructed in the shape of a large umbrella, giving easy access to the tanks. Units are built with the tanks radiating out like the spokes of a wheel, or located at the outer edge of the circle like the rim of a wheel.

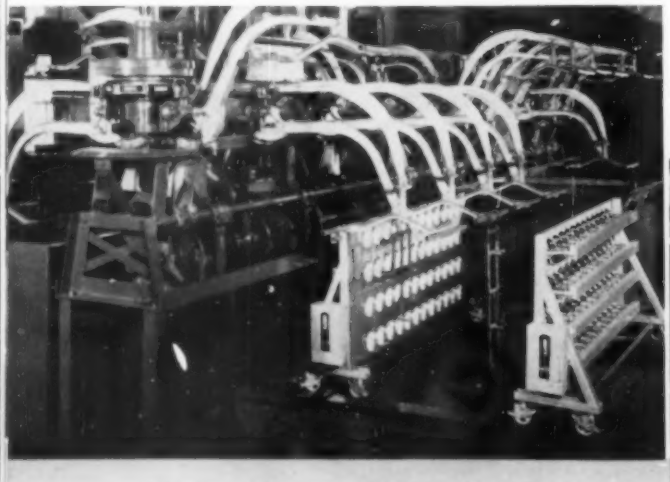
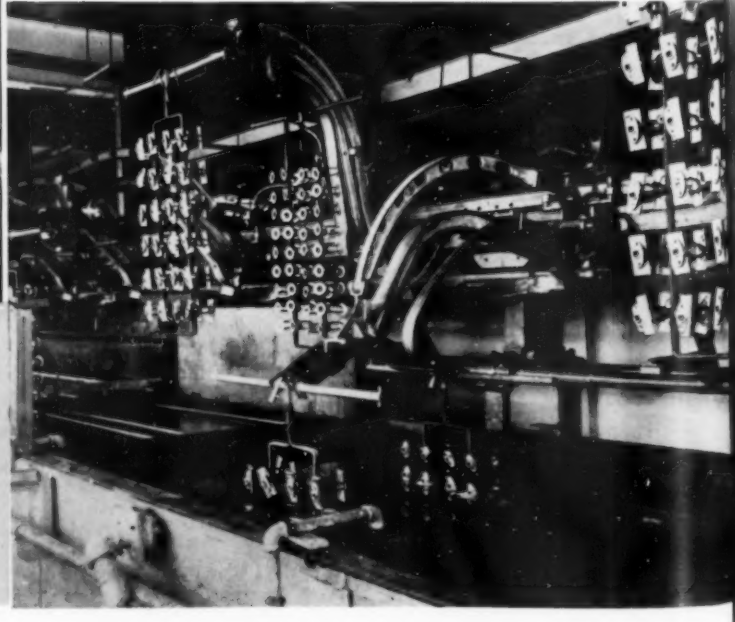


Fig. 8. (Above) This full automatic plating machine has a double row type carrier arm of the non-agitating type. An auxiliary drier is shown at right.

Fig. 9. (Right) A continuous movement machine with double row type agitating arm in the transfer and down position.



Automatic Loading

In conjunction with the full automatic machines, automatic loading and unloading equipment is available, thus making the complete operation automatic, *Figs.* 10, 11 and 12. The loader conveyor carries the racks directly to the racking station, eliminating the need of labor for loading and unloading the machines, as well as any incidental transportation by trucks. In some cases, the conveyor may be brought down to working height at the racking station and the parts to be plated can be racked and unracked without removing the racks from the conveyor. In addition, the racking area can be located at a distance from the plating installation, away from fumes and dirt.

Where space is at a premium, the loading mechanism can be used in an intermediate location between two small machines. This is particularly desirable when there is not enough room to install a large machine. An additional advantage is that much manual handling of the racks is eliminated.

Plant Layout

Planning a plating room calls for detailed information concerning the product such as specifications for the plating, the size, bulk, production rate, base metal and shape, etc. Once these factors have been determined, the required equipment can be selected and a layout made. Shown in *Fig.* 13 is a flow chart applicable to most barrel plating in acid as well as alkaline solutions. A solvent degreasing operation is occasionally used prior to item 1. A bright dip followed by water rinses sometimes

comes between items 8 and 9. Chromate solutions may be added between 8 and 10, and a drag-out rinse used between 7 and 8.

The layout in *Fig.* 14 is typical for a return type barrel plating installation. Item 1 is the loading station. If work is processed through the cleaning cycle in perforated monel cylinders, time and labor may be saved by using a steel stand to hold the cylinder while being loaded from tote boxes. Another variation is to mount a throttled chute on the stand and fill it with work, raising it with overhead hoist on a monorail and dumping the contents into the cleaning cylinder.

At station 2 is the alkali cleaner tank. Work to be barrel plated is generally soak cleaned in monel baskets (small lots or precision parts) or tumble cleaned in motorized, perforated monel cylinders. The latter produces much better results and is about 400 percent faster. Combined electro-cleaning and tumble cleaning is even better for some types of work. Here, cylinder material is the problem. A metal cylinder will absorb most of the current.

In the cold water rinse at station 3, there is a plain steel tank with a dam overflow and drains. If a monel metal cylinder is used, it should be motorized in order that the work be tumble rinsed.

Station 4 is for pickling, either soak or tumble, in sulphuric or muriatic acid. The steel tank should be lined with acid-resistant material. Rubber lining is not suitable for chromic or nitric acids. Tumble pickling is more uniform and about four times faster than soaking.

The cold water rinse at station 5 is similar to the one at 3, except the tank should be lined with lead or some other acid-resistant material.

Item 6 is the cyanide or weak acid dip. For alkaline plating, the tank should contain a weak cyanide solution; for acid plating, a weak sulphuric solution is desired. This unit will prevent rusting of cleaned work, act as temporary work storage, act as a means for transferring work from cleaning to plating cylinders, and bridge the space between two monorail systems, *Fig.* 15. When monel cylinders are used, the tank may be equipped with special handling equipment.

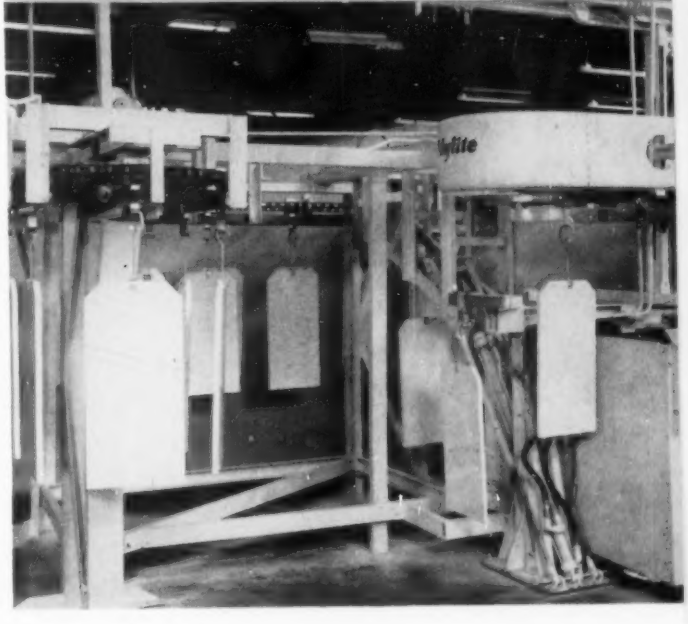
Station 7 is a five-cylinder barrel plate unit. Facts on the selection of proper barrels cannot be covered in a general statement. However, the following points should be checked: Cylinder speed should be between 3 and 6 rpm for the average run of work; cathode contacts should have ample current-carrying capacity, withstand wear and load impact, be easily cleaned, bury selves in work, and not deform it. Temperature limitations and load: Barrel cylinders made of conventional materials are limited to 160 F or less to prevent warping. Newer materials permit temperatures to over 180 F in both acid and alkaline solutions. In loading, relative area, shape and weight of the pieces to be plated must be watched so that the plate is uniform. Panel perforations should be as close together as possible without unduly weakening the panels. Line voltage usually should be from 10 to 12 volts. Higher voltages might burn the work or overheat the solution. The barrel should have adequate ventilation, located so that it does not interfere with the operation. Other considerations are barrel productivity, tank construction, heating and cooling.

Plated work may be rinsed at station 8 in the plating cylinder (not general because of drag-out), in a hopper-type or perforated chute rinse, or in automatic drum-type equipment. The method of drying largely determines the rinsing equipment selected.

Station 9 is the hot water rinse. To keep water free from rust, the tank may be lead-lined, the chute made of stainless steel, and the steam coil of lead or stainless.

The dryer is located at station 10. Standard equipment can be used. It may be a rotating drum type where production is high. It should be of the centrifuge type for drying precision parts.

Fig. 10. This loader mechanism eliminates labor required to remove racks from and replace racks on the plating machine.



Individual layouts are usually required for each plant. However, there are a number of general requirements to be considered in each instance. The layout should permit processing through the entire cycle with minimum operator effort and time. Bottle necks are to be avoided by balancing equipment so that adequate equipment exists for cleaning, rinsing and drying, as well as for plating. When estimating requirements, it is best to determine the size and number of barrels and then select auxiliary equipment. The equipment should be so arranged that drag-out from one solution will not contaminate another. Ample aisle space should be provided. Electrical equipment should be readily accessible and not jammed against the wall. Long runs of bus bars from generators or rectifiers should be avoided. The operation should be analyzed to select the most efficient method of handling the work, utilizing electric hoists and monorails or bridge cranes as indicated.

Electroplating Process

Electroplating with specific metals calls for many combinations of baths, cleaners, dips, etc., depending upon the finish and the materials. One of the prime considerations, however, is cleaning the material before plating so that there will be no contamination of the solution, and a uniform layer of metal will be deposited with no holes or irregularities. The deposited layer of metal will not adhere to the basis metal if there is an objectionable film present.

Organic solvents and vapors are used principally to remove greases and waxes which may have been deposited on the basis metal during machining, grinding or buffing. Emulsion cleaning is also helpful in removing these substances. These two types of cleaning are usually called precleaners, used prior to electrolytic or immersion cleaning.

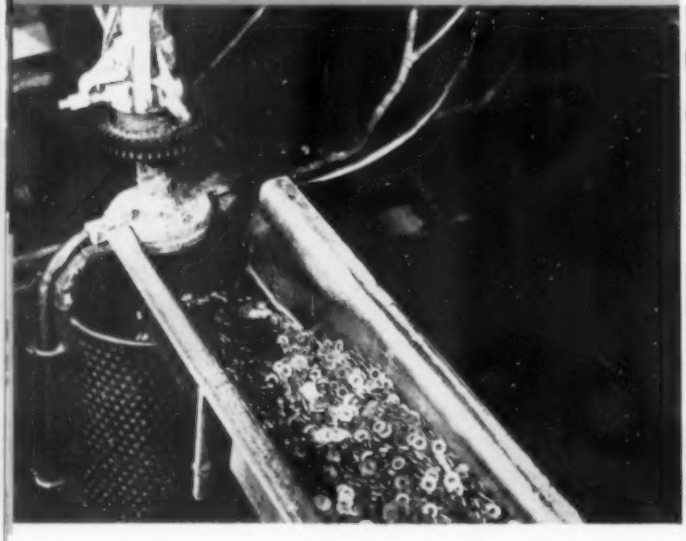
Electrolytic cleaning is almost always the final step in the process before the actual plating takes place. It involves passage of a current through a hot alkaline solution with the articles to be cleaned constituting one of the electrodes. Parts to be barrel-plated in bulk are difficult to clean electrolytically; therefore, the immersion process is employed.

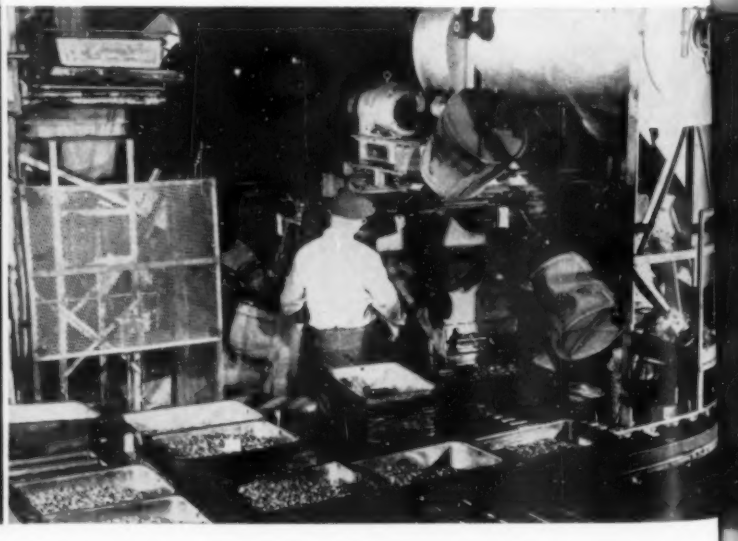
After the soil has been removed from the workpiece, there is usually still an oxide film to be removed. This film may be the result of corrosion, or it may be in the form of scale or some other deposit left during forming or machining operations. The most common method of removing these films is by dissolving them with an acid. Pickling is the term used to refer to severe or continued treatment, while the term dipping refers to a short treatment of less than one minute.

In addition, various mechanical methods of cleaning are employed such as shot blasting, deburring, buffing, grinding and burnishing. These operations usually precede the final chemical cleaning before plating. Recommended practices have been prepared and published by the ASTM in an

Fig. 11. (Below left) Washers are weighed to issue maximum pound load for production in a full automatic barrel plating and processing machine.

Fig. 12. (Below right) This automatic load device and automatic barrel unloading station is incorporated as part of a straight flow operation.





effort to coordinate these essential steps for plating certain metals. It must be emphasized that these recommendations are still in the tentative stage.

For the actual electroplating process itself, the most common metals used are cadmium, chromium, copper, lead, nickel, silver, and zinc. Other metals are also used, but in much smaller degree. Each of these metals can be deposited from a number of kinds of bath. Expert knowledge is required concerning the chemical composition of these solutions so that no general recommendations can be made. TABLE 2 shows some of the general plating characteristics of these metals.

Cadmium, usually plated in thicknesses of 0.00015 to 0.0005 inch, is an excellent protection for iron or steel, particularly in salty atmospheres. While it has definite disadvantages, it is widely used because it is easily applied.

Chromium plate has high tarnish resistance except to chloride atmospheres. The plate has good abrasive wear qualities and finds extensive use as a top coating over nickel in decorative service and over steel for industrial purposes.

Copper is usually plated prior to nickel to facilitate the buffing to a prescribed luster and to obtain good adhesion and coverage of the basis metal. It is also used as a cover for brass or steel in some applications. There are a number of copper-plat-

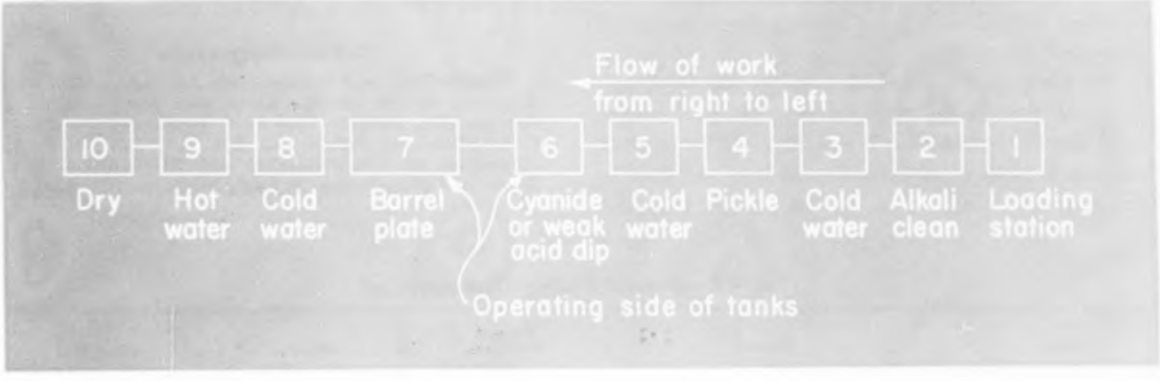
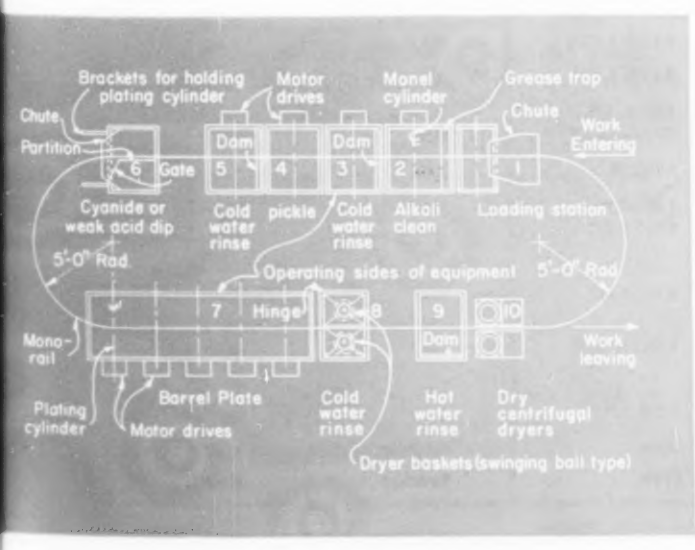
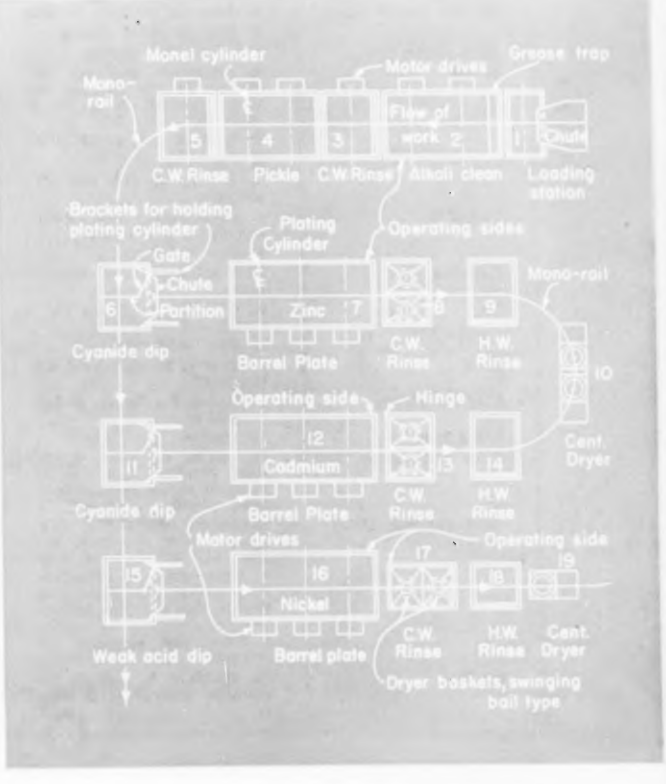


Fig. 13. (Above) General flow chart of a straight line operation.

Fig. 14. (Below) Return type for barrel plating equipment.

Fig. 15. (Right) Layout of barrel plating equipment for deposition of several metals.





ing processes available, depending on the purpose of the deposit. They differ in respect to the type of solution from which the metal is deposited.

Lead coatings find few applications, but where they are used, substitutes would be hard to find. Lead is the standard coating against dilute sulphuric acid corrosion, and sometimes against hydrofluoric acid. It is also favored as a coating over steel for structural purposes where the coating is covered with paint.

Nickel is the most important of the metals used in the electroplating process from the standpoint of dollar value and the volume used. It is the backbone of protective and decorative plating, and for successful results, the solution must be prepared and maintained to close requirements.

Silver is used mainly for coating domestic silverware and for jewelry.

Tin platings are admirably suited for food and beverage containers, refrigerator parts and household utensils because tin is not attacked by organic acids, and gives good protection to iron and steel in the absence of oxidation. At the present time the continuous plating of strip steel for canning constitutes a sizable portion of the electroplating industry.

Zinc plating or electrogalvanizing is the standard finish for protecting iron and steel against rust. It is considerably less expensive than cadmium, which accounts for its widespread use for tonnage items. It protects steel by galvanic action whereby it is consumed in the process. The amount of protection therefore depends on the thickness of the deposit. The ease with which the thickness of the coating may be regulated is one of the chief advantages of the plating method over the hot-dip method of galvanizing. Other advantages are uniformity and ductility of the deposit and freedom from brittle alloy layer and thermal effect.

Acknowledgments

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Table 8—General Plating Characteristics*

Plating	Purpose	Unusual Thickness (inches)	Abrasion Resistance	Flexibility
Acid zinc	Rust protection	0.0005-0.0010	Poor	Fair
Cyanide zinc	Rust protection	0.0005-0.0010	Poor	Fair
Cyanide Copper	A. Base for oxidized finishes	0.0001-0.0003	Fair	Fair
	B. Base for nickel plating	0.0001-0.001	Fair	Fair
Acid copper	Base for nickel plating	0.0003-0.0006	Fair	Fair
Nickel	A. Appearance and rust resistance directly on steel (as plated, buffed, or scratch brushed)	0.0003-0.002	Good	Fair
	B. On steel over copper plate	0.0003-0.0008	Good	Fair
	C. Copper or brass	0.0002-0.0006	Good	Fair
	D. Directly on zinc and aluminum	0.0003-0.0005	Good	Poor
Chromium	A. Appearance. Over nickel and nickel plus copper	0.00001-00002	Fair	Poor
	B. Wear resistance	0.0002-0.008	Excellent	Poor
Cadmium	Rust resistance and appearance	0.0002-0.0006	Very poor	Good
Tin	A. Corrosion resistance on copper and brass	0.0003-0.0010	Very poor	Excellent
	B. Wear resistance	0.0010-.003	Very poor	Excellent
Brass	Appearance (often colored and lacquered)	0.0001-0.0003	Fair	Good
Rhodium iridium	Reflection. Usually over nickel. Decorative	0.000005	Poor	Fair
White brass	Appearance	0.001-0.002	Fair	Poor
Black molybdenum	Decorative. On zinc, aluminum, cadmium, and zinc or cadmium-plated steel, copper, brass, nickel	0.001-0.002	Fair	Poor
Black and gray nickel	Decorative. On nickel, zinc, brass, copper, aluminum, and zinc, and nickel-plated steel	0.001-0.002	Poor	Poor
Silver	A. Appearance and reflection. Over nickel and nickel plus copper, also corrosion protection	0.0001-0.0005	Good	Good
	B. Wear and corrosion resistance	0.001-0.005	Good	Excellent
Anodize	On aluminum 1. Sulfuric for corrosion protection. 2. Chromic acid	None	Excellent	Good
		None	Excellent	Good

*Data courtesy of A. H. Petersen

Planing, Shaping and Slotting

In addition to listing speeds and feeds, the accompanying two tables together with the formulas provide a basis for estimating the time required for a planing, shaping or slotting job. One table gives speeds and feeds for various materials and cutting tools. The other tabulates net cutting speeds to facilitate calculations for machining time. Certain variables in equipment such as acceleration or deceleration at the ends of the stroke, and actual reversal itself should be included in the efficiency factor when calculating machining time. On some older types of machines this would definitely be a factor and would influence the result.

Speeds and feeds are affected by many variables such as condition of the machine, uniformity of work and rigidity of setup. The data given should be considered in the nature of a broad general guide subject to modification depending upon specific conditions. The information is presented by courtesy of the Rockford chapter of the ASTE and the Rockford Machine Tool Co.

Estimating Job Time: Net cutting speed may be obtained from the chart on the following page or from the following formula:

$$S_n = \frac{S_c\, S_r}{S_c + S_r}$$

where

S_n = net cutting speed, fpm
S_c = cutting speed, fpm
S_r = return speed, fpm

The net cutting speed is one-half the average speed of the cutting and return strokes.

Machining time is (converting S to inches):

$$T = \frac{L\, W}{12 e F\, S_n}$$

where

L = length of work, in.
W = width of work, in.
F = feed, in.
e = machining efficiency
T = machining time, min.

For a machining efficiency of 85 percent, this formula becomes:

$$T = 0.098\, \frac{L\, W}{F\, S_n}$$

On multiple setups, divide by number of pieces per setup to obtain machining time per piece. For complete job time estimate other job factors such as setup time, load and unload time, and tool changing time must be figured and prorated per piece.

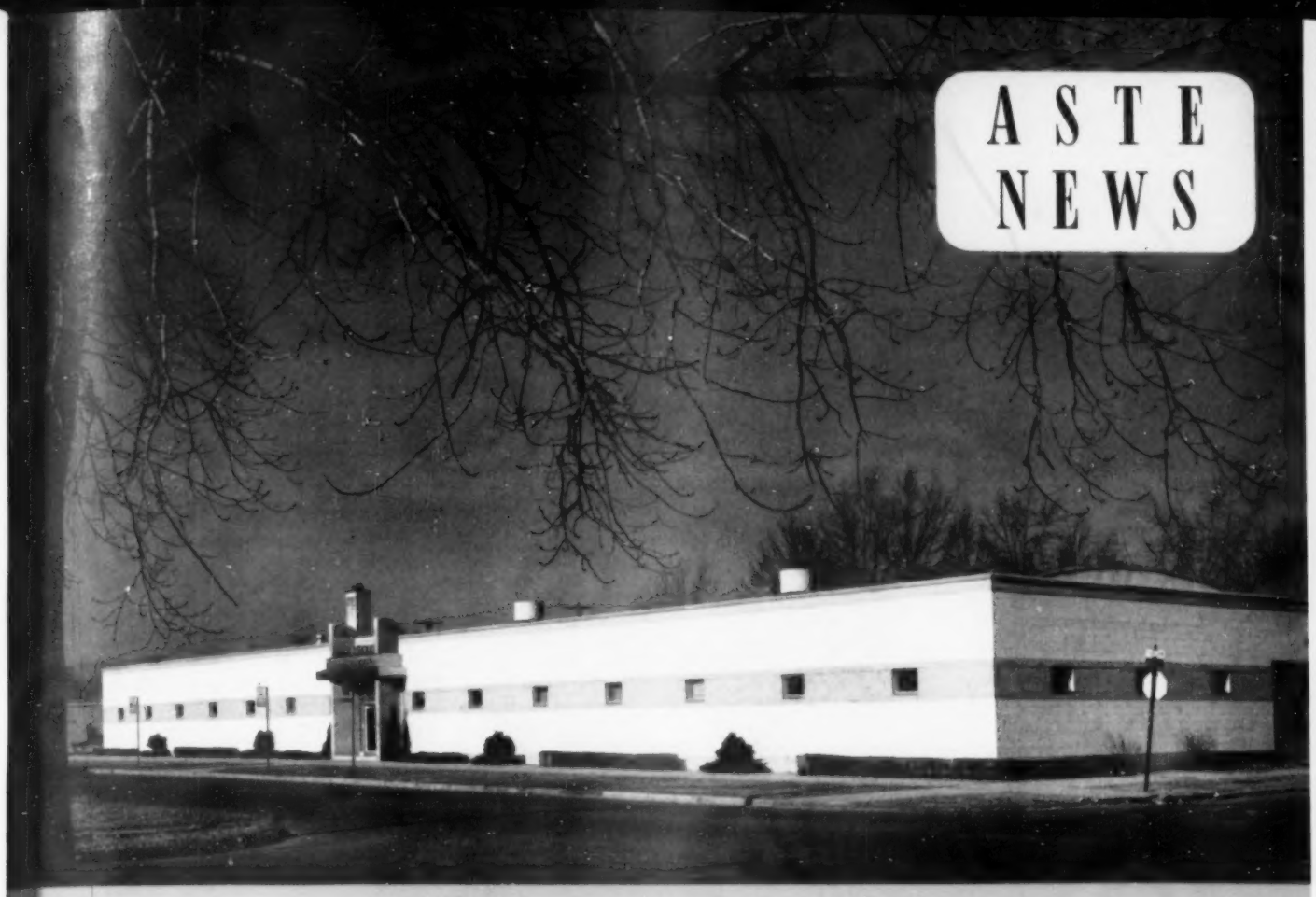
Net Cutting Speed

Cutting Speed (fpm)	Return Speed (fpm)																									
	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300
20	14.3	15.0	15.5	16.0	16.4	16.7	16.9	17.1	17.3	17.5	17.6	17.8	17.9	18.0	18.1	18.2	18.3	18.3	18.4	18.5	18.5	18.6	18.6	18.7	18.7	18.7
25	16.7	17.6	18.4	19.0	19.6	20.0	20.4	20.7	21.0	21.2	21.4	21.6	21.8	21.9	22.1	22.2	22.3	22.4	22.5	22.6	22.7	22.8	22.9	22.9	23.0	23.1
30	18.7	20.0	21.0	21.8	22.5	23.1	23.6	24.0	24.4	24.7	25.0	25.3	25.5	25.7	25.9	26.1	26.2	26.4	26.5	26.7	26.8	26.9	27.0	27.1	27.2	27.3
35	20.6	22.0	23.3	24.3	25.2	25.9	26.6	27.1	27.6	28.0	28.4	28.7	29.0	29.3	29.6	29.8	30.0	30.2	30.4	30.5	30.7	30.8	31.0	31.1	31.2	31.3
40	22.2	24.0	25.4	26.7	27.7	28.6	29.3	30.0	30.6	31.1	31.6	32.0	32.4	32.7	33.0	33.3	33.6	33.8	34.1	34.3	34.5	34.7	34.8	35.0	35.2	35.3
45	23.7	25.7	27.4	28.8	30.0	31.0	31.9	32.7	33.4	34.1	34.6	35.1	35.6	36.0	36.4	36.7	37.1	37.4	37.6	37.9	38.1	38.4	38.6	38.8	39.0	39.1
50	25.0	27.3	29.2	30.8	32.1	33.3	34.4	35.3	36.1	36.8	37.5	38.1	38.6	39.1	39.6	40.0	40.4	40.7	41.1	41.4	41.7	41.9	42.2	42.4	42.6	42.9
60		30.0	32.3	34.3	36.0	37.5	38.8	40.0	41.1	42.0	42.9	43.6	44.3	45.0	45.6	46.2	46.7	47.1	47.6	48.0	48.4	48.7	49.1	49.4	49.7	50.0
70			35.0	37.3	39.3	41.0	42.8	44.2	45.5	46.7	47.7	48.7	49.6	50.4	51.2	51.9	52.5	53.1	53.7	54.2	54.7	55.2	55.6	56.0	56.4	56.8
80				40.0	42.4	44.4	46.3	48.0	49.5	50.9	52.2	53.3	54.4	55.4	56.3	57.1	57.9	58.7	59.4	60.0	60.6	61.2	61.7	62.2	62.7	63.2
90					45.0	47.4	49.5	51.4	53.2	54.8	56.2	57.6	58.8	60.0	61.1	62.1	63.0	63.9	64.7	65.5	66.2	66.9	67.5	68.1	68.7	69.2
100						50.0	52.4	54.5	56.5	58.3	60.0	61.5	63.0	64.3	65.5	66.7	67.7	68.7	69.7	70.6	71.4	72.2	73.0	73.7	74.4	75.0
110							55.0	57.4	59.6	61.6	63.5	65.2	66.8	68.3	69.7	71.0	72.2	73.3	74.4	75.4	76.4	77.3	78.2	79.0	79.7	80.5
120								60.0	62.4	64.6	66.7	68.6	70.3	72.0	73.5	75.0	76.4	77.6	78.9	80.0	81.1	82.1	83.1	84.0	84.9	85.7
130									65.0	67.4	69.6	71.7	73.7	75.5	77.2	78.8	80.3	81.7	83.1	84.3	85.5	86.7	87.7	88.8	89.8	90.7
140										70.0	72.4	74.7	76.8	78.7	80.6	82.4	84.0	85.6	87.0	88.4	89.7	91.0	92.2	93.3	94.4	95.5
150											75.0	77.4	79.7	81.8	83.8	85.7	87.5	89.2	90.8	92.3	93.7	95.1	96.4	97.7	98.9	100
160												80.0	82.4	84.7	86.9	88.9	90.8	92.6	94.4	96.0	97.6	99.0	100	102	103	104
170													85.0	87.4	89.7	91.9	93.9	95.9	97.8	99.5	101	103	104	106	107	109
180														90.0	92.4	94.7	96.9	99.0	101	103	105	106	108	110	111	112
190															95.0	97.4	99.7	102	104	106	108	110	112	113	115	116
200																100	102	105	107	109	111	113	115	117	118	120
210																	105	107	110	112	114	116	118	120	122	124
220																		110	112	115	117	119	121	123	125	127
230																			115	117	120	122	124	126	128	130
240																				120	122	125	127	129	131	133
250																					125	127	130	132	134	136
260																						130	132	135	137	139
270																							135	137	140	142
280																								140	142	145
290																									145	147
300																										150

Speed and Feed for Shapers and Planers

Work Material	Type of Tool							
	High Speed Steel		Alloy High Speed		Cast Alloys		Carbides	
	Speed (fpm)	Max. Feed (inches)	Speed (fpm)	Max. Feed (inches)	Speed (fpm)	Max. Feed (inches)	Speed (fpm)	Max. Feed (inches)
Aluminum	200 to 300	Deter. by finish	*	*	*	*	Max. of Mach.	3/16
Brass (Soft)	150 to 250	0.250	*	*	*	*	Max. of Mach.	3/16
Bronze (Medium)	75 to 125	0.075	*	*	*	*	150 to 300	0.050
Bronze (Hard)	30 to 60	0.050	50 to 70	0.050	50 to 100	0.040	150 to 200	0.050
Cast Iron (Soft)	50 to 80	0.125	60 to 100	0.125	90 to 120	0.050	110 to 225	0.050
Cast Iron (Hard)	30 to 50	0.060	40 to 60	0.060	50 to 80	0.050	100 to 200	0.050
Malleable Iron	50 to 90	0.090	70 to 110	0.090	80 to 120	0.050	150 to 250	0.050
Cast Steel (30 Carbon)	25 to 60	0.050	40 to 70	0.050	60 to 80	0.040	100 to 180	0.040
Steel (Soft)	70 to 100	0.050	80 to 120	0.050	*	*	180 to 300	0.050
Steel (Medium)	60 to 70	0.060	70 to 90	0.060	*	*	180 to 250	0.050
Steel (Hard)	20 to 35	0.035	30 to 50	0.035	*	*	100 to 180	0.035

Note: Data based on an average depth of cut of 1/2 inch. Speed increases up to 50 percent are frequently possible on light finishing cuts.
* This tool not recommended for this application.



ASTE NEWS

featured this month . . .

The entire National Education Committee, pictured here, was on hand for the Purdue Conference. From left: C. Douglas Wright, Prof. J. N. Edmondson, Prof. W. W. Gilbert, Prof. M. L. Begeman, Chairman A. R. Diamond, Prof. O. D. Lascoe and Prof. Frederick Preator.

ASTE Scholarship Fund Established at On-Campus Tool Engineering Conference

By Nancy L. Morgan

An ASTE All-Indiana Chapter Scholarship Loan Fund of $375 for students planning to major in tool engineering or allied programs was established at the On-Campus Tool Engineering Conference held April 18 at Purdue University, Lafayette, Ind. The fund, in the name of the American Society of Tool Engineers, will be administered by Purdue University. It was established through the efforts of Frank C. Hockema, vice president and executive dean at Purdue, and Arthur F. Diamond, chairman of ASTE's National Education Committee.

The On-Campus Tool Engineering Conference, sponsored by the Evansville, Fort Wayne, Indianapolis, Muncie, Richmond and South Bend ASTE chapters and Purdue University's Department of General Engineering and Division of Adult Education, drew a record attendance of more than 300 persons.

Hear Purdue Officials

The group was welcomed by F. L. Hovde, president of the university, and heard talks made by Dean Hockema and Roger F. Waindle, national president of the Society. Other national representatives of ASTE present for the conference included: Howard C. McMillen, third vice president; R. C. W. Peterson, secretary and acting chairman of the National Standards Committee; A. B. Clark, chairman of the National Membership Committee; Prof. L. E. Doyle, chairman of the National Professional Engineering Committee; H. D. Long, chairman of the National Finance Committee; Thomas C. Barber, National Program Committee; and the entire membership of the National Education Committee.

With special activities planned for the ladies' program, the conference provided tours of Purdue's outstanding machine tool laboratories, luncheon and dinner meetings, and two technical sessions.

Halsey F. Owen, professor of manufacturing processes and general chairman of the conference, was moderator for the afternoon panel on machining of hard-to-machine materials. Participants and their specific topics were: "Electro-Mechanical Machining" by Malcolm F. Judkins, chief engineer, High Temperature Alloys Div., Firth-Sterling Steel and Carbide Corp., Pittsburgh; "Electrolytic Grinding" by George Keeleric, research consultant, Super-Cut, Inc., Chicago, and W. L. Hardy, grinding engineer, Norton Co., Worcester, Mass.; "Ultra-Sonic Machining" by Arthur Kuris, president, Cavitron Equipment Co., New York City; and "Electro-Sparking Machining" by H. V. Harding, chief engineer, Elox Corp. of Michigan, Clawson, Mich.

All five methods discussed have one thing in common, each uses electricity in one form or another to produce the results. Each method is several years old, but is still in the development stage with improvements being constantly made in cutting time, surface finish, and mechanical application.

The importance of these methods to the tool engineer lies in the fact that materials such as cemented carbides, stellite, hardened steels, and even glass and ceramics can be cut, shaped, drilled and tapped with comparative ease and in a comparatively short time. The application to tools, dies, molds, jigs and fixtures is almost unlimited.

Newport Presents Lecture

A lecture on "Grinding of Shapes of Non-Circular Cross Section" was presented at the morning session by H. L. Newport, instructor in manufacturing processes. Chairman for the program was O. D. Lascoe, professor of manufacturing processes.

"For non-cylindrical shapes," Mr. Newport said, "the machine must be

equipped to vary the position of the axis of rotation of the workpiece with respect to the face of the grinding wheel or vice versa. This is the essence of shape grinding."

American manufacturers of grinding machines use both methods in producing shapes. Some use an attachment on a standard machine to produce irregular shapes which others build a special machine for the purpose.

With most American equipment the shape is produced by a master cam, Mr. Newport said. The size of the grinding wheel has an effect on the product size. The shapes that can be ground are almost unlimited. There is a grinding machine produced in Europe that does not use a master cam. The grinding wheel size does not affect the size of the workpiece. It is limited to five shapes: cylinder, triangle, square, ellipse, and eccentric. This machine used the method of producing its shapes by varying the wheel face with respect to a fixed axis of rotation of the workpiece. The method of producing these shapes is what makes this machine interesting and is the basis for the accuracy with which the machine produces them.

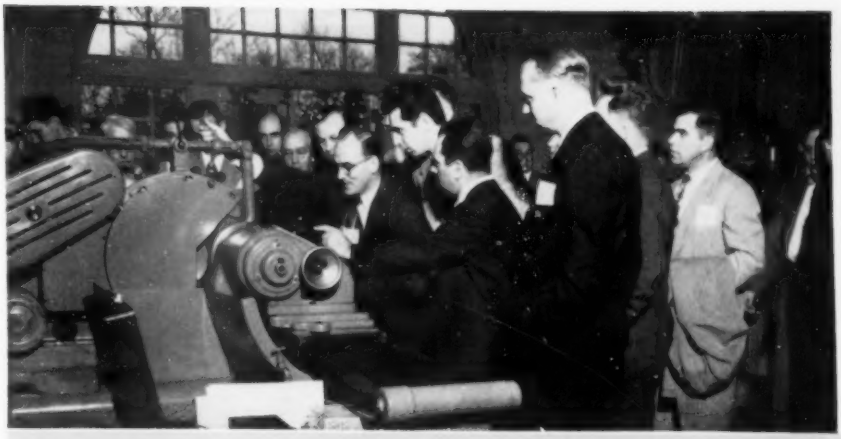
Richard Mossdorf, a gear expert in Germany, filed for patent in 1935 for a machine that would produce polygon shapes. He took his ideas to the Krause Co. in Vienna and in 1939 this firm developed the "K" profile grinding machine.

Polygon Developed

Mr. Newport stated that this machine could produce by the aid of a kinematic gearing of the work piece and an oscillating grinding wheel, precise triangle profiles, both internal and external, with perfect congruence. Using the experience of about 200 "K" profile machines produced, the polygon machine was developed. It is a much better machine than the "K" profile grinder in that it is able to produce more shapes, produce them faster and more accurately.

Investigations are being conducted at the present time by several companies in the United States as to the validity of the triangle polygon shape. Tests are being conducted to find the advantages of this shape to replace splines, keyways, pins and other types of couplings and to determine the forces involved. It is known that the shapes can be produced faster and more accurately than the spline, Mr. Newport said.

Machine information and slides were presented at the conference through the courtesy of: The Bryant Chucking Grinder Co., Springfield, Vt.; Landis Tool Co., Waynesboro, Pa.; The Cincinnati Milling Machine Co., Cincinnati; and S & S Machinery Co., Brooklyn, N. Y.



Purdue Instructor H. L. Newport demonstrates a polygon grinder for visitors.

ASTE members study facilities for metal cutting research at the university.

Students demonstrate screw machine production in the machine tool laboratory.

Pictured at the Tool Engineers Day banquet, held at the New Yorker Hotel, from left, are: Arthur Cervenka, George Bennett, Hill N. Nolton, Joseph E. Ridder, Richard A. Smith, Roger Waindle, Clyde Shannon, Joseph Crosby, Hartley W. Barclay, Harry E. Conrad, Lt. Gen. K. B. Wolfe, Robert Frechman, Kenneth H. Rockey, Harold S. Vance, Eugene Roth, Joseph Crane, Charles Bazaz, William Rogers and Carl Kertez.

Studebaker President Addresses Tool Engineers Day Audience

The substitution of industrial capacity, ready for quick action in an emergency, for part of the country's military stockpile, was urged by Harold S. Vance, president of the Studebaker Corp. and consultant to the Office of Defense Mobilization, at the evening banquet of the Tool Engineers Day Observance held April 14 in New York City.

Mr. Vance expanded on a plan for this method of strengthening for defense that he had advanced to the defense agency in January in his capacity as chairman of the advisory committee on production equipment.

Twelve-Hour Celebration

He was one of several speakers at the dinner at the New Yorker Hotel which climaxed a twelve-hour celebration by the Greater New York, Long Island, Northern New Jersey, Mid-Hudson, Paterson, and Fairfield County chapters of the American Society of Tool Engineers.

The purpose of the observance which drew messages of approval and good wishes from Governor Thomas E. Dewey of New York and Governor Alfred E. Driscoll of New Jersey, was "to honor the achievements of America's industry-engineering team in bulwarking peace, security and progress by cooperation in technical advancement and to interpret these advances to the public."

At the dinner were 700 industrialists, engineers, designers and educators, most of whom during the day toured various industrial plants. Among them were New York Naval Shipyard, Mergenthaler Linotype Co., New York Times and Times Facsimiles Corp., Reeves Instrument Corp., Kollsman Instrument Corp., and American Machine & Foundry Co.

National Officials Participate

Representing the national headquarters of the Society were Roger F. Waindle, national president; Harry E. Conrad, executive secretary; Thomas J. Donovan, Jr., national director; and Arthur R. Diamond, chairman of the National Education Committee.

In addition to Mr. Vance the speakers included: Lieut. Gen. K. B. Wolfe, retired president of the Oerlikon Tool and Arms Corporation of America; Joseph E. Ridder, board chairman of American Bosch Corp. and of Arma Corp. and publisher of *The Journal of Commerce*; Mr. Waindle, ASTE president; and

Eugene Roth, president of Eugene Roth, Inc. and chairman of the Greater New York chapter.

Mr. Vance said he believed his plan would make possible a substantial reduction in the cost of "military hardware" without impairing military strength and without reducing national security.

Would Not Further Inflation

In this way, he declared, national security "can be maintained over an extended period, let us say for ten years, at a cost which we can bear, which will not impair our civilian economy or lead to deficit spending and further inflation."

He said that when military stockpiles are full, production capacity too often is allowed to deteriorate, and that military end-items in such stockpiles often become rapidly obsolete.

General Wolfe, who commanded the Twentieth Bomber Command, first B-29 organization to bomb Japan during World War II, urged greater emphasis on research and development in production processes applied to military equipment. He called for greater development of production equipment, processes and techniques and more attention to the use of new production materials.

As an industrial executive, Mr. Ridder commented on "a tendency to produce tools so complicated that they defeat their purpose." He urged simplification as an objective and said there are "vast areas of unexplored techniques, especially in the field of electronic controls."

Significant Changes Promised

He offered the "push button" as symbolic of the challenges of present-day engineering and of the progress already made in the automation of machines and processes. "The push button promises as significant changes in industry and commerce as were introduced by the coming of electricity of synthetic organic chemistry.

Mr. Ridder said the purpose of the industrial and commercial push button is to lessen the cost of making more and better products that more people can afford and have time to enjoy. A typical social effect will be a higher and higher status for the tool engineer and demand for his kind far exceeding the present 25,000 membership in the various chapters of ASTE.

"Equally good economic effects will be felt in all branches of engineering with the premiums growing all the time for those who can devise controls and those who know most about adapting them to the needs of production," Mr. Ridder said.

Governors' Messages

". . . The functions of tool engineers in our mighty industrial fabric should have full public attention and appreciation. It is no exaggeration to say that America has the most advanced, highly trained and proficient body of engineers in the entire world. This excellence has been developed as an integral part of our magnificent system of free enterprise. The supremacy of American engineering has been acknowledged with mixed admiration and envy in all other countries.

"Our tool engineers constitute an essential element of this system. Without them our leadership in the production both for peace and war would not exist. Their fabulous capacity for creating the instruments gives us an unequalled standard of living. Also, in two World Wars, they enabled us to triumph over the efforts of the aggressor nations which heavily outnumbered us." **—Thomas E. Dewey, New York.**

". . . Tool engineers have been among the groups most responsible for the blessings of mass production in the United States. Mass production has given us labor-saving products for our convenience and other products for our entertainment at a cost which has made them available to millions of Americans.

Successful tooling up for mass production enabled the United States to be the Arsenal of Democracy in World War II. Today we are looking once again to such tooling up and productivity to assure us of adequate defense against possible aggression and attack by a government which we befriended when its people were attacked and its existence was at stake. Strength on our part may deter aggressors. We know that our trained tool engineers will help to give us that indispensible strength."

—Alfred E. Driscoll, New Jersey.

ASTE Award Winners Announced

Winners of the American Society of Tool Engineers' International Education Awards for engineering students in American universities have been announced by Roger F. Waindle, national president of the Society. Each award is for $700 for the school year starting in September, 1953, and is made on the basis of scholastic standing, recommendations by faculty members and the interest shown by the student in furthering the profession of tool engineering.

Winners are: Thomas P. Baker, Queen's University, Kingston, Ont.; Jay Beazer, Utah State Agricultural College; Cornelius R. Biteler, Purdue University; George C. Haettinger, Ohio State University; Leonard Kranser, Rensselaer Polytechnic Institute; Bruce MacGregor, University of Michigan.

Nathan Oser, University of Pennsylvania; Franklin W. Ridgway, University of Illinois; Richard W. Wambach, Cornell University; and Kenneth D. Wilson, University of Iowa.

This is the third year the awards have been made, but is the first time ten award winners have been selected. The amount of the individual awards was increased this year from $300 to $700.

"We believe our Society is aiding in the development of competent tool engineers through these Education Awards. The continued advancement of our high standard of living and the protection of our freedom is dependent on the quality and quantity of America's engineers in the future years. Our Society comprises more than 25,000 production experts in 106 chapters in the United States and Canada. From our integral roles in industry, we know the importance of developing more and more engineers," Waindle said in announcing the award winners.

The winners were selected by ASTE's National Education Committee, headed by A. R. Diamond. Other members of the committee were: M. L. Begeman, professor of mechanical engineering, University of Texas; J. N. Edmondson, professor of industrial engineering, Ohio State University; William W. Gilbert, professor of production engineering, University of Michigan; O. D. Lascoe, professor of manufacturing processes, Purdue University; Frederick Preator, head of Tool Engineering Department, Utah State Agricultural College; and C. Douglas Wright, plant engineer, Houdaille-Hershey Co., Oshawa, Ontario, Canada.

The Canadian award winner, Thomas Baker, 22, is a junior at Queen's Uni-

(Continued on Page 92)

Education Awards Go to Ten Outstanding Engineering Students in U.S. and Canada

(Continued from page 91)

versity, where he is an executive member of the Engineering Society and a student member of the Engineering Institute of Canada, the Ontario Association of Professional Engineers, and the American Society of Mechanical Engineers. To gain practical experience in his chosen profession and to help pay for his university education, he has worked in Canadian gold mines and as an instrument mechanic in a chemical manufacturing plant. His scholastic rank is tenth in a class of 160.

Second in his class at Utah State Agricultural College in Logan, Jay Beazer is 27 and a junior student working for a bachelor of science degree in tool engineering. He served during the war as a motor machinist's mate in the U.S. Navy and has worked as a junior machinist in the precision grinding department at Hill Air Force Base in Ogden, Utah. He is a member of the Salt Lake City chapter of ASTE, Utah Engineering Council, Sigma Tau, Tool Engineers Club and Campus Presidents Club.

Baker

Beazer

Biteler

Haettinger

A senior at Purdue University, Lafayette, Ind., Cornelius Biteler, 21, has worked for Signode Steel Strapping Co. and Ross Gear Co. to aid in paying for his education. He is a member of the American Society of Mechanical Engineers and is night engineer at the West Lafayette Water Co.

George Haettinger, 31, senior at Ohio State University, Columbus, is one of three married men to win an Education Award this year and has two children, 9½ and 6. He served in the U.S. Navy 2½ years and has worked for Hooven and Allison Co., Xenia, Ohio, and for Jeffrey Mfg. Co., Columbus. He is a member of an honorary industrial engineering society and ranks in the upper third of his class scholastically.

Leonard Kranser, 21-year-old senior at Rensselaer Polytechnic Institute, Troy, N.Y., ranks first scholastically in a class of over 600. He has worked for Consolidated Edison Co., Gibbs and Cox, Inc., and Sykes and Hennessy, Inc. Active in extra-curricular activities, he is a member of the varsity swimming

Kranser

MacGregor

Oser

Ridgway

team, the debating team, sports editor of the campus newspaper, literary editor of the yearbook, president of his fraternity, member of Tau Beta Pi, Pi Tau Sigma, Pi Delta Epsilon, and the American Society of Tool Engineers.

R. Bruce MacGregor, 22, is a married student in the senior class at the University of Michigan in Ann Arbor. A member of the upper sixth of a class of 185, he has worked for King Engineering Corp. as a draftsman and will receive a bachelor of science degree in industrial engineering this June. A member of the student chapter of ASTE at the University, Phi Eta Sigma, and Tau Beta Pi, he will begin work toward a masters degree this fall.

A Junior at the Towne School, University of Pennsylvania, Nathan Oser, 36, is another married student. He operated his own poultry farm to earn money for his education. He is a member of ASM.

Franklin Ridgway, 21, a junior at the University of Illinois, Urbana, has worked for Dixon Research, Inc., and Ingersoll Milling Machine Co. He is a member of Sigma Phi Epsilon, a number of R.O.T.C. organizations, and the Interfraternity Council.

Richard Wambach, 21, a senior at Cornell University, Ithaca, N.Y., ranks 13th in a class of 116. He is a member of Phi Tau Sigma, Kappa Tau Chi, Pi Delta Epsilon, American Society of Mechanical Engineers, Engineering Student Council, Alpha Delta Phi, Ski Patrol, Cornell Yacht Club, and is an instructor at the Cornell Ski School.

Wilson

Wambach

Kenneth Wilson is 22 and a senior at the University of Iowa, Iowa City. He has worked in job machine shops and as a test engineer at Amana Refrigeration, Inc., to gain money for his education. He is a member of Pi Tau Sigma, Theta Tau, and is president of the student chapter of American Society of Mechanical Engineers and is editor of the *Iowa Transit* magazine. He stands in the upper third of his class.

Hitchener Mfg. Co. Toured by ASTE Chapter

Milford, N. H.—With a plant tour affording ASTE'ers a more authentic outlook on the manufacture of precision investment castings, members of the Granite State chapter held their April program at the Hitchener Mfg. Co. The chapter viewed the entire process, beginning with the die manufacture, the wax or plastic pattern and its "Christmas Tree" spruing through to the investment baking process and finally the gate removing, finishing operation.

After dinner, Edward M. Broad, chief metallurgist in charge of research and development, spoke on "Metallurgy of Investment Castings," and William B. Shuman, head of the sales department, spoke on "Design for Use of Investment Castings."

Jacob J. Repetto, chapter chairman, presented the past chairman's pin to James D. Wilson, who was 1952-53 chairman. *—C. P. Radwan*

University of Michigan Students Receive Charter

Past President L. B. Bellamy, right, administered the oath of office to Bruce MacGregor, head of the new student group at the university.

The first student chapter of the Society was established April 28 when a group of 68 engineering students at the University of Michigan in Ann Arbor received a temporary charter from ASTE. Since there are, as yet, no specific provisions in the present constitution and bylaws of the Society for the operation of student chapter, formation of the chapter with certain limitations was approved by ASTE's Board of Directors. Operation of this new chapter will be studied to determine the advisability of revising the Society constitution and provide for the operation of other student groups.

The charter banquet of the University of Michigan group was held at the American Legion home. Nearly 75 members and guests were present for the ceremonies and technical session which followed.

L. B. Bellamy, past national president and a national director of the Society, conducted the election and installation of temporary officers. They are: R. Bruce MacGregor, chairman; Edward Schneider, first vice chairman; Charles Averill, second vice chairman; A. Mahadavan, secretary; D. A. De Varti, treasurer; Victor L. Brooks, delegate; and Larry De Boer, alternate.

The temporary charter was presented by Charles M. Smillie, past chairman of the National Professional Engineering Committee. The Chairman's pin was presented by National Director W. B. McClellan.

Guests at the meeting were Grant S. Wilcox, Jr., past national director; Stanley C. Phillips, first vice chairman of the Detroit chapter; Delmar Asplund and James McMahan, Waterloo chapter, Prof. W. W. Gilbert, Robert Caddell, P. R. Visser, and K. H. Moltrecht, chapter faculty advisor, represented the University of Michigan. The group was welcomed by Prof. Gilbert and the guests were introduced by Edward Schneider.

The technical talk was made by Dr. A. O. Schmidt, director of metal-cutting research, Kearney & Trecker Corp., Milwaukee. His subject was "Engineering Solutions to Machine Shop Problems." Dr. Schmidt presented a discussion on thermodynamics in relation to metal-cutting research.

Meeting Sponsored at Western Metals Congress

Los Angeles—One of the highlights of the recent Western Metals Congress and Exposition held March 23-27 was the session sponsored March 26 by the Los Angeles chapter of ASTE at the Hotel Statler. The two-hour meeting combined a technical address and a review of national activities.

The technical program was presented by W. O. Sweeney, chief engineer, Arwood Precision Casting Corp., New York, who spoke on "Precision Investment Casting." Mr. Sweeney is author of several technical articles, books, and lectures and helped to write the section on precision investment casting in the *Tool Engineers Handbook*.

The ASTE portion of the program was presented jointly by Wayne Ewing, national assistant secretary-treasurer, and S. W. Winquist, member of the Los Angeles chapter. They spoke on "The Past, Present, and Future of ASTE."

In his address, Mr. Ewing related the courage of the founders of the Society, the obstacles and setbacks that had to be overcome in order to establish tool engineering as a specialized profession apart from other engineering endeavors. He told of the progress from the first charter meeting in 1932 when 114 members formulated the policies that led ultimately to current membership of over 25,000 among 106 chapters in the United States and Canada.

Attending the ASTE session at the Western Metals Congress were: Anton Peck, Dick Lynch, Los Angeles Chairman S. W. Winquist, Assistant Secretary-Treasurer Wayne Ewing, W. O. Sweeney and Frank Bale.

Mr. Winquist spoke on the education and scholarship programs that are being carried out in the Los Angeles chapter. He described the courses that were offered last year at UCLA and the current ASTE classes sponsored at USC.

Discussing the extension classes offering work allied with tool engineering, Mr. Winquist said it is felt that these courses will lead to the establishment of a degree program soon to be offered by USC as a result of interest stimulated by ASTE. *—Lew W. Goodwin*

Montreal Members Hear P. R. Noling

Montreal—At their April 9 meeting, nearly 100 members of the Montreal ASTE chapter heard a talk by P. R. Noling, sales engineer, Barber-Colman Co. His subject was "Hobbing of Precision Gears."

Mr. Noling told of the problems encountered from the time the customer places the order until the final inspection of the gears. A question and answer period provided time for a number of members to get help on their own particular problems.

—George Henderson

Chapter Chartered at Tucson, Arizona

Above: Principals at the installation of officers for the Tucson ASTE chapter were, from left: Wayne Ewing, national assistant secretary-treasurer of the Society, Jim Beach, chapter chairman; Ben Hazewinkel, a national director; and Glenn Quillen, first vice chairman. Below: Officers of the 106th chapter of the American Society of Tool Engineers are sworn in.

At ceremonies held April 14, the 106th chapter of the American Society of Tool Engineers was chartered at Tucson, Arizona. The new chapter adds 98 members to the Society comprised of more than 25,000 production experts in the United States, Canada and 11 other countries.

Installation officers for the event were Wayne Ewing, assistant secretary-treasurer, and Ben J. Hazewinkel, a national director of ASTE. Mr. Ewing gave a history of the Society and presented the charter to Chairman James Beach. The oath of office was administered by Mr. Hazewinkel.

Serving as charter officers of the chapter, in addition to Mr. Beach, are: Glen Quillan, first vice chairman; Harry McLain, second vice chairman; Cy Jacobson, secretary; Robert Howard, treasurer; James Matthew, delegate; and Ted Crewler, alternate.

Other highlights of the dinner meeting held at the American Legion Hall were the presentation of the chairman's pin to James Beach and the membership kit to Charles Green, membership chairman.

Representatives of the Mountain States Telephone & Telegraph Co., W. C. Axtel and C. Reese, staged a demonstration of microwave transmission and showed a film illustrating the telephone companies' position and extensive work in the television industry.

Coming MEETINGS

DETROIT—June 4, 6 p.m. Tour of Willey's Carbide Tool Co., 1340 W. Vernor Hwy. Processing of Tungsten carbide metals and tools.

ERIE—June 20, Skibinski's Grove, Wattsburg Road. Annual picnic.

FAIRFIELD COUNTY—June 3. "Presses Geared for Automatic Production" by William W. Schug, The V & O Press Co.

FOX RIVER VALLEY—June 9, 1 p.m. Tour of Electromotive plant, La Grange, to study manufacture of diesel engines.

GRAND RIVER VALLEY—June 6. Tour of the Richard L. Hearn Power Station, Toronto.

HARTFORD—June 6, Bond Hotel, annual Hartford Night meeting. Speaker will be Henry D. Sharpe, Jr., president, Brown & Sharpe Mfg. Co.

HOUSTON—June 6, 2-8 p.m., Clear Lake. Bar-b-cue and family picnic.

INDIANAPOLIS—June 19, Hotel Traylor. Annual Ladies' Night. Dinner and dancing.

LIMA—June 20, Lost Creek Country Club. Stag party, golf tournament and buffet luncheon.

LONG ISLAND—June 9, 7:30 p.m., Chex Mimi Restaurant, Montauk Highway, Lindenhurst, N.Y. First dinner meeting of the chapter.

LOS ANGELES—June 11, 7:30 p.m., Scully's Restaurant. Lecture on atomic energy program. June 19, 11 a.m., Raucho Golf Club. Annual golf tournament.

MEMPHIS—June 12, 7 p.m., King Cotton Hotel. Program to be presented by Dr. Stewart G. Fletcher, chief metallurgist, Latrobe Steel Co., Latrobe, Pa.

MILWAUKEE—June 19, Tuckaway Country Club. Annual golf outing.

NEW HAVEN—June 6, 9 a.m., country home of F. W. Gilbert, River Road, Mt. Carmel, Conn. Full day of activities scheduled.

PITTSBURGH—June 5, Daniel's Farm, McKnight Road. Annual picnic.

SAGINAW VALLEY—June 20, 8 a.m., Bridgeport Country Club, Bridgeport, Mich. Annual golf outing.

ST. LOUIS—June 4, 6:30 p.m., Hotel DeSoto. Ladies' Night. Program to be presented by Leonard Hall, naturalist, author and authority on outdoor life.

SANTA CLARA VALLEY—June 16, 7 p.m., Tour of Columbia Geneva Steel Co., Pittsburg, Calif. Dinner will be served at the plant cafeteria.

SOUTH BEND—June 20, Indian Lake Golf Club. 14th annual picnic.

SPRINGFIELD (Ill.)—June 2, 6:30 p.m., The Mill. Speaker will be Harry Conn, chief engineer, Scully-Jones & Co., Chicago.

TORONTO—June 5, Uplands Golf Club. Annual field day.

The Student Group of the Greater New York chapter transferred recently to the Long Island ASTE chapter. Pictured here with Long Island chapter officers, seated, are: Janet Johnson, student recording secretary; Rudy Ramcke, student vice chairman; Ray Huntington, student chairman; and Horton Errett, student secretary. Standing: Sheldon Meyers, Long Island delegate and business manager of the chapter bulletin; Mrs. Sara T. Moxley, editor of the bulletin; Arthur Cervenka, chapter chairman; and George McLaughlin, second vice chairman of the chapter.

Students Transfer to Long Island Chapter

Farmingdale, Long Island—The first meeting of the student group of the Long Island chapter since its transfer from the Greater New York chapter was held April 14 at Long Island Agricultural and Technical Institute. Arthur Cervenka, Long Island chapter chairman, welcomed the students and presented a gavel to Ray H. Huntington, chairman of the group.

Mrs. Sara T. Moxley, editor of the bulletin, spoke on the work of the editorial committee, emphasizing the important role filled by the chapter bulletin in keeping chapter members informed. The student group was invited to send in material for publication. Brief talks were also made by George McLaughlin, second vice chairman, and Sheldon Meyers, chapter delegate. Among the guests at the meeting was Locke James, assistant to the director of LIAT.

Technical speaker for the program was Melvin Richards, sales engineer, Greenfield Tap and Die Corp., Greenfield, Mass. He narrated a film produced for Greenfield on the history of man's efforts to fasten metal to metal from early Grecian days through the ages to present-day manufacture. A dynamic question and answer period followed his presentation. *—Sara T. Moxley*

Colonial Broach Official Addresses Tulsa Chapter

Tulsa—Technical speaker at the April 9 meeting of the Tulsa chapter was Harry Gotberg, vice president, Colonial Broach Co., Detroit. About 35 members heard his discussion at Lorton Hall, on the campus of the University of Tulsa.

Mr. Gotberg presented a film describing the history of broaches and provided the narration. The movie pictured a great number of specially designed machines that are used for mass production of automobile parts which could not be produced any other way.

—Ed Schroedeck

Detroit ASTE Group Tours Carboloy Dept.

Detroit—The Educational Section of the Detroit chapter toured the Carboloy Dept. of General Electric Co. at their meeting held April 16. More than 80 members participated in the program.

After an introduction by R. W. Reinhardt, chapter technical chairman, John Curtis of Carboloy welcomed the group. The main speaker, R. Brierly, manager of training, presented a talk on the history of tungsten carbide. The tour showed all phases of manufacture of the "industrial vitamin," including new developments, examples of items produced, and the training school.

On April 9 Detroit ASTE members heard a talk on tapping problems by Harry Conn, chief engineer, Scully-Jones & Co., Chicago. The meeting was held at the Rackham Building, home of the Engineering Society of Detroit.

—Robert Reinhardt and Walter Schober

Bethlehem Steel Works Toured by Erie Chapter

Lackawanna, N.Y.—A tour of the Bethlehem Steel Works at Lackawanna was featured at the April program of the Erie ASTE chapter. More than 100 members saw the unloading of ore from ships at dock and all of the phases of manufacture, including rolling of structural steel and the charging of blast furnaces.

Luncheon was served at the Lackawanna Hotel. Arrangements for the tour were made through George Cushman, general sales manager of the company. J. A. Frick headed the guides, company police and bus drivers who accompanied the chapter.

—H. W. Sedler

Vacuum Testing Topic for Richmond Program

Richmond, Ind.—Two speeches on vacuum testing were heard April 14 at the meeting of the Richmond ASTE chapter held at the Leland Hotel. Speakers were Dick Whittington, president, and Lawrence Sterns, chief engineer for Whittington Pump and Eng. Co., Indianapolis.

Demonstrations were made and the many types of vacuum pumps and the uses of vacuums for testing castings and fabricated parts were explained. Their discussions were presented for nearly 70 ASTE members and guests.

—Dezéll Gibbs

Speaker Reviews Uses of Diamond Tools

Oshkosh, Wis.—Members of the Fond du Lac ASTE chapter held their April 10 meeting at the American Legion Club at Oshkosh. Chairman E. J. Kaiser gave a report on the annual meeting and Leadership Conference held in Detroit. More than 75 members and guests attended the session.

A technical talk on "Uses of Diamond Tools in Industry" was delivered by Walter J. Meinhardt, president, Meinhardt Diamond Tool Co., Chicago. He also showed a color film he had taken on a recent hunting trip in Nevada.

—Robert M. Hanson

Named Full Professor

Orville D. Lascoe, a member of ASTE's National Education Committee, has been advanced to the rank of full professor of manufacturing processes, Department of General Engineering at Purdue University, Lafayette, Ind., according to a recent announcement made by Dean A. A. Potter of the university.

Twin Cities ASTE officers were sworn in at the March meeting by Past Chairman Peter S. Tobias, far right. Others pictured include: Donal A. Reiner, alternate delegate; Louis M. Walton, treasurer; Philmore W. Armstrong, secretary; Robert M. Johnson, second vice chairman; Jerome W. Schwartz, first vice chairman; and C. Eric Fasth, chapter chairman.

Plant Tour Draws Twin Cities Visitors

Minneapolis—The World Tool and Engineering Co. was host April to the Twin Cities chapter for a dinner and plant tour. The firm manufactures complex dies, molds, gages and other tools. About 250 ASTE members and their guests participated in the events.

In March the chapter met at St. Paul Vocational High School and heard a talk by LeRoy Owen, sales representative of the Carpenter Steel Co., Reading, Pa. He discussed selection of tool steels and causes of die failure, pointing out the evils of overheated steel during heat treating. Slides illustrated his talk. *—Walter J. Comstock*

70 New Members Join Fairfield County Chapter

Bridgepork, Conn.—Membership in the Fairfield County chapter of ASTE now stands at 224, a 35 percent increase in the past year, according to an announcement made at the last meeting held at the Hitching Post Inn. The chapter voted its thanks for the work of P. Marsilius who made the record possible. Seventy new members were added to the chapter roster.

The technical program was handled by Irving Rivkin, sales representative, Wheel Traveling Tool Co. He spoke on "Diamonds and Their Uses in Industry. *—Robert A. Brechter*

New Positions for Two Binghamton Men

Two members of the Binghamton ASTE chapter recently received new assignments at the Endicott plant of International Business Machines. Philip M. Taylor was appointed manager of typemaking and engraving, alphabet counter manufacturing and rachet counter manufacturing departments.

Stark E. Roberts was named manager of the bench lathe and gear-cutting department.

Present Verson Program at Dayton ASTE Meeting

Dayton—Close to 50 members and guests of the Dayton chapter met April 13 at Suttmiller's Restaurant to attend a program presented by the Verson All-steel Press Co. Two representatives of the firm, Melvin Verson and E. J. O'Connell narrated three color films on transmat presses, tooling and manufacture of washer units, and hot extrusion of large caliber projectiles. The question and answer period brought out several highlights on presses and tooling as well as the Verson hydraulic forming system.

At the chapter's short business meeting, Chairman R. A. Miller and Vice Chairman Roy Dusseau discussed and showed a sample of the new program announcement to the members.

—W. J. Killinger

At a recent meeting of the Columbus ASTE chapter, Past Chairman Jack Mitchell, left, presented the chairman's pin to Emmett A. Bartlow. Speaker at the technical session was E. A. Brezina of the Cleveland Twist Drill Co. His topic was "Uses and Abuses of Twist Drills."
—Roscoe Zwoll

Newly installed officers of the Milwaukee ASTE chapter, from left to right, are: Ralph Lund, treasurer; Steve Pohlhammer, secretary; Robert E. Bodendoerfer, first vice chairman; and Eugene J. Anspach, chapter chairman. Not present when the photograph was taken was Harvey Wolff, second vice chairman. The men took office on March 12.

La Crosse Chairman Edward Giroux, third from left, receives congratulations from H. Philpot, installing officer at the March meeting. Others pictured, from left, are: E. Ted Neubauer, second vice chairman; W. Bertelson, secretary; Frederick Horak, first vice chairman; and R. Phillips, treasurer. The meeting served as the Ladies' Night program of the chapter. Speaker was Paul R. Leach, Jr., of E. I. Du Pont de Nemours & Co.
—Frederick Horak

Research Director Speaks at Nebraska ASTE Meeting

Lincoln, Neb.—At the first meeting following its chartering, the Nebraska chapter of ASTE met March 26 at the Italian Village to hear Chairman Joe Duncanson's report of the Leadership Conference and annual meeting and a talk by Bernard Better, director of research at Scully-Jones & Co., Chicago.

Illustrating his discussion with slides, Mr. Better told how his company is developing a better tap chuck. He outlined how the problem was approached, the many designs needed and the number of experiments required.

The president of Scully-Jones, Dale Long, a national committee chairman for ASTE, was a guest at the meeting.
—William L. Ferguson

Tool Superintendent Gives Chapter Program

Springfield, Ohio—The Robbins and Myers Co., makers of pumps, cranes, hoists and electric motors, was host for a recent meeting of the Springfield ASTE chapter. The superintendent of the company's tool division, Gilbert Hagerman, spoke to the group on "Lamination Dies, Progressive Type."

He gave a brief history of the development and use of these dies in the Robbins and Myers plant and told of various problems in design and material which were encountered. Large drawings and an extensive display of dies illustrated the program.

After Mr. Hagerman's talk, a question and answer session was held, followed by a tour of the punch room. Arrangements for the meeting were made by John Horstman and Roger Horstman of Robbins and Myers.
—E. W. Carmichael

Ladies' Night Attracts Record Hamilton Crowd

Hamilton, Ont.—The annual Ladies' Night program of the Hamilton District ASTE chapter was held April 17 at Fischer's Hotel. A record attendance of 104 couples was on hand for the dinner and dancing.

A short comedy "Cinderella" was presented in pantomime under the direction of Harold Millet. Mrs. Jack Yorick read the script and Mrs. Robert Stewart accompanied on the piano. Others participating were: Jack Yorick, David Wilson, Jim Hodgson, Bill Durant, and Gordon Hall.

A silver plate was presented to Mrs. William Shaw, wife of the immediate past chairman, and other gifts were given to Mrs. Jean England, Mrs. Hall, Mrs. Frank Taylor, Mrs. Lorne Coady, and Mrs. Frank Evans. *—John Litwin*

Dearle Retires After 24 Years with Carboloy

Vernon H. Dearle, Carboloy's Michigan district manager of sales and one of the first members of the Detroit chapter of the American Society of Tool Engineers, retired on June 1, after 24 years' service with the company.

Known to his friends and associates as "Mr. Carbides" for the extensive pioneering work he did in the automotive industry with tungsten carbide cutting tools, Mr. Dearle has been an active member of the Detroit chapter since 1929. His association with carbides dates from 1928 in Schenectady, N.Y., where he was present during the first tests of tungsten carbides manufactured in this country.

As the first salesman for the Carboloy Department of General Electric Company in Detroit, Mr. Dearle, in his role as salesman and engineer, probably contributed as much to the techniques of mass producing automobiles as any individual associated with mass production in this industry. His introduction of these fast performing tools to the industry led to the many automated setups now in operation.

Flight Engineer Talks to Saginaw Valley Members

At their April meeting nearly 100 members of the Saginaw Valley ASTE chapter heard a talk by Robert E. Reed, flight research engineer, Allison Div., General Motors Co., Indianapolis. He spoke on the development of the Allison turbo-liner, the cost of the development, and the time required for such a project. Slides illustrated his discussion and a lively question and answer period followed it. *—Ben Phillips*

A dinner in honor of all past chairmen of the South Bend chapter was held April 14. Present for the event, seated, were: Ed Helm, Carl Steveson, Art Regan and Stanley Cope. Standing: Lawrence Haverstock, Paul Beehler, John Yoder and Herb Goltz. Technical movie of the multipress were shown through the courtesy of Denison Engineering Co., Columbus, Ohio. Uses of air valves and toggle pads were explained by representatives of the Samuel Harris Co. and an exhibition of a ten-inch lathe was provided by representatives of the South Bend Lathe Works. **—Matthew J. Novak**

Los Alamos officers were installed in March by Norman C. Bezek, far right, past chairman of the chapter. From left are shown: Harold H. Hawk, treasurer; Joseph B. Bourne, secretary; Robert H. Moeller, first vice chairman; and Frank J. Elliot, chairman. Virgil B. Brown is serving as second vice chairman. The special service pin was awarded to Robert H. Moeller. More than 100 members and guests attended the dinner meeting held at the Los Alamos Golf Club. The coffee talk was made by David B. Tod of the Los Alamos Toastmasters Club.

Toronto ASTE Chapter Honors Douglas Cooper

Toronto—Ten past chairmen were among the 145 members who attended the April 1 meeting of the Toronto ASTE chapter. One of them, Douglas Cooper, was awarded the service pin for his outstanding chapter work during the past year. The technical program for the evening was presented by George B. Miller, chief engineer, Racine Hydraulics and Machinery, Inc., Racine, Wis. He spoke on applications of hydraulics.

Describing the recently developed variable volume pump, Mr. Miller said use of such a pump, by delivering only enough oil required for effective operation of the hydraulic system, eliminates waste horsepower, reduces heating in the oil and achieves peak performance. The variable volume pump insures the simplest hydraulic circuit to accomplish any hydraulic operation.

—A. McKinney Rice

New Haven Members Study Wire Rope Manufacturing

New Haven—American Steel & Wire Co. welcomed members of the New Haven ASTE chapter for a plant tour on April 9. The plant visitation was followed by a dinner meeting held at the Hotel Garde. On the tour members witnessed the operations required in manufacturing wire rope, including all the processes of handling and testing.

The technical speaker was Albert P. Hayden of American Steel & Wire Co., who discussed wire rope, its uses and the problems of manufacture. Assisting him were Robert H. Saviers, metallurgist, M. Brownell, engineer, and John Herr, rope engineer, who narrated a series of slides shown to the chapter.

—Silas Becroft

Low Temperature Alloys Discussed by O. J. Seeds

Los Alamos—"The Utilization of Low Temperature Alloys in Modern Industry" was discussed April 15 by O. J. Seeds, Cerro de Pasco Corp. of New York City, at a meeting of the Los Alamos ASTE chapter. About 40 members and their guests heard his address.

Mr. Seeds described the physical properties of the various bismuth alloys and how they could be utilized in repairing dies, holding complex punch assemblies, bending tubes, and as patterns for electroforming intricate mechanisms.

—H. J. Von Steeg

John Schwab Speaks to Greater Lancaster Group

Lancaster, Pa.—"The Next Ten Years for the Tool Engineer" was the subject discussed at the April meeting of the Greater Lancaster chapter by John L. Schwab, president, John L. Schwab & Associates, Bridgeport, Conn. He stressed the importance of having the knowledge of productivity in advance of tool design. He elaborated on the conformances for measurement and briefly demonstrated the application of predetermined time standards using methods-time-measurement procedure.

During a short business session, Chairman Ray Moorhead announced the appointment of James Boyer as chapter historian. Guests present for the meeting included John Stauffer, superintendent of Stevens Trade School in Lancaster, and Raymond Meckley, chairman of the Central Pennsylvania chapter of ASTE.

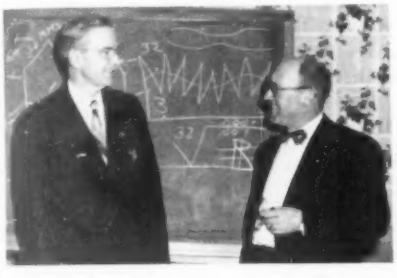
—George J. Coil

Dick Taisey of Rivett Lathe and Grinder Co. brought his robot man "Luigi" to the April 9 meeting of the Boston chapter. Mr. Taisey spoke on hydraulic pumps and circuits. "Value Analysis through Dollar Sign Engineering" was discussed by another speaker, L. D. Miles, manager of value analysis at General Electric Co., Schenectady. About 175 members and their guests attended the meeting at New England Mutual Hall.

O. J. Seeds, second from right, manager of the alloys division of Cerro de Pasco Corp., New York City, spoke on low melting alloys and their applications at the April meeting of the Denver chapter. Others pictured, from left, are: C. W. Keller, president of the Colorado Engineering Council, who also addressed the meeting; C. J. Helton, chairman of the chapter; and W. H. Parks, secretary-treasurer of the Colorado Engineering Council.

Harrington Talks on Dimensional Control

Fort Wayne—At the April 8 meeting of the Fort Wayne ASTE chapter held at the Chamber of Commerce, Everett Keese reported on the ASTE annual meeting and Leadership Conference held in Detroit. Other talks were made by Captain Pierre Boucheron, manager of radio station WGL, and John A. Harrington, DoAll Co., Des Plaines, Ill.



John Harrington, left, and Blaine Garard, first vice chairman.

Mr. Harrington talked on dimensional control and presented many new uses for optical flats and monochromatic light. He displayed an extensive exhibit of gage blocks and inspection gages.

—Richard G. Spaw

ASTE Chapter Tours Bell Aircraft Plant

Ft. Worth—The latest type of machinery and the modern methods employed at the new Ft. Worth Division of the Bell Aircraft Corp. were studied by 75 members of the North Texas ASTE chapter who visited the plant on April 17. The tour, preceded by dinner served in the plant cafeteria, was made while the evening shift was in operation. Company representatives escorted the group through each phase of manufacture, from fabrication of intricate gears and sheet metal parts to final assembly of the finished product.

—F. Paul Simpson

Cincinnati Chapter Meets with ASM Members

Cincinnati—ASTE members of the Cincinnati chapter were host April 14 to the local chapter of American Society for Metals at a program on graphite tool steels. About 80 representatives of both groups met at the Engineering Society of Cincinnati for the technical session.

The speaker was A. F. Sprankle, metallurgical engineer in charge of service and tool steels for the steel and tub division of the Timken Roller Bearing Co. He has worked at Battelle Memorial Institute in metallurgical research and is a special lecturer at Carnegie Institute of Technology.

In presenting his subject, Mr. Sprankle covered the chemical analyses, molecular structure, machinability and unusual wear properties and applications of this class of tool steels.

He said graphite steels owe their excellent machinability and unusual wear properties to .40 percent of free graphite which appears as finely dispersed particles. Approximately 500,000 of these particles can be counted per square inch of area and these particles provide a bearing surface with the inherent lubricating nature of graphite.

—Louis F. Schumann

Full Program Greets Twin States Chapter

Claremont, N.H.—A diversified program was presented for some 60 members and guests who attended the April 8 meeting of the Twin States chapter held at the Hotel Moody. A color and sound film produced for Bryant Chucking Grinder Co. pictured the principles of alignment as applied to internal grinding, and a technical talk was given on the trends in machine design with a supplementary discussion on the uses of a mock-up.

At the business meeting, Alternate Delegate Martin Parker reported on the annual meeting held in Detroit and Chairman George Julien made a few remarks on the Leadership Conference and dedication of the ASTE headquarters building.

The featured speaker was Herbert Rosengren, industrial designer, Woodcliffe, N.J. He spoke on design trends, from the simple functional designs through automatic machine designs. He emphasized the importance of cooperation of the engineer and industrial designer to incorporate eye appeal, ease of machine operation and lines to stress machine rigidity. Slides illustrated the principles of good industrial designing.

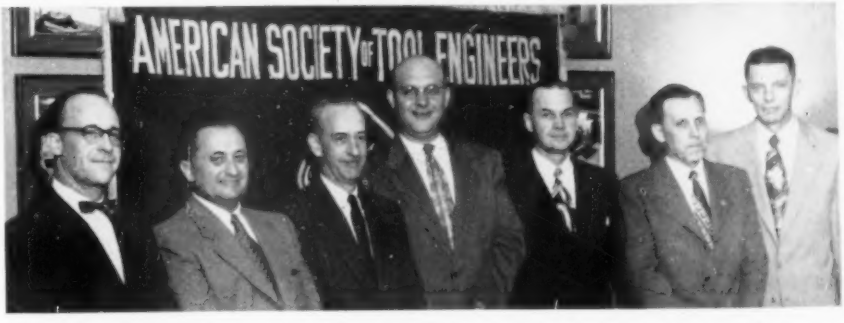
—Harold M. Noyes and Stacey Farrell

J. Y. Riedel Addresses Springfield ASTE Chapter

Springfield, Ill.—Program speaker at the April meeting of the Springfield chapter was J. Y. Riedel, tool steel engineer with the Bethlehem Steel Co., Bethlehem, Pa.

The subject of his talk was "Tool Failures and Tool Trouble Shooting," a practical analysis of proper tooling procedures. Slides were shown to illustrate typical tool failures gathered from actual practice. A discussion period was included in the session, held as part of a dinner meeting at the Mill.

—Charles Collier



Past chairmen of the North Texas ASTE chapter attended the installation of officers held March 6 at the Engineers' Club in Dallas. From left: R. E. Hager, I. H. Buck, P. D. Browne, Fred Bates, John Lapham, E. L. Minch and A. E. Unruh.

Rudy Regen Heads Slate of San Fernando Officers

North Hollywood—A new slate of officers was installed at the March meeting of the San Fernando Valley chapter. Serving with Chairman Rudy Regen are: Kurt Kerseg, first vice chairman; Henry T. Young, second vice chairman; K. H. Griffin, secretary; and C. L. Goodspeed, treasurer. More than 215 members attended the meeting.

The guest speaker, Dr. W. R. Frazer, discussed the subject "High Rake Milling." He cited a number of case histories where milling cutters incorporating the high rake angle design had been used with great success in the machining of various grades of steel as well as nonferrous metals.

At the February session, Past President Leslie B. Bellamy was the featured speaker. He emphasized the vital part each chapter plays in welding, through mutual pursuits, a strong national organization. Visiting the chapter with Mr. Bellamy were Ben Hazewinkel, member of the ASTE board of directors, John Stansbury and Leslie F. Hawes.

A talk on stud drivers was given at the technical portion of the meeting by George H. Eisler of the Remington Arms Co. —*C. D. Colvey*

Gaging Discussed by Sheffield Representative

Chicago—Meeting at the Keymans' Club on April 6, more than 150 members and guests heard a lecture on gaging delivered by W. Fay Aller, director of research for the Sheffield Corp., Dayton. He presented two movies showing the application of air gages for measuring diameters and bores and various types of applications using air gages for quality control, automatic gaging, and checking hole centers. A stimulating question and answer period followed his discussion. —*R. C. Berliner*

Installation ceremonies for the Mid-Hudson chapter were conducted by Joseph P. Crosby, seated, left, first vice president of the Society. With him are Stanley P. Cook, Mid-Hudson chairman, and Robert Gay, membership captain for the Greater New York area. Standing: Felix R. Adams, secretary; J. H. Keller, treasurer; Richard Fitzgibbons, second vice chairman; and H. J. Tesmer, first vice chairman of the chapter.

Sponsors Engineering Council Meeting

Atlanta—On April 13 the ASTE chapter in Atlanta sponsored a joint meeting with the Georgia Engineering Society. Speaker at the noon luncheon session was Pat Bernal, representative of Delta Air Lines, who talked on "Inside Operation of Air Lines." The program was arranged by the ASTE chapter. Among those seated at the speakers' table were Charles D. Toney, jr., ASTE chairman, and Frank F. Ford and James F. Weideman, past chairman of the chapter.

On April 20 the chapter heard a talk on modern heat treating and gaging techniques as applied to drill jig bushings and similar precision parts. Technical speaker was Charles S. Einsiedler, president, Accurate Bushing Co., Garwood, N.J.

Such points as bushing standards, methods of heat treating, gaging, and tool steel classification were treated with their specific application focused toward bushing manufacture. Considerable emphasis was directed toward surface finishes obtained and the importance of achieving close concentricity between the hole and outside of the bushing.

An outstanding feature of the meeting was the presentation of the service award to Frank Ford, the outgoing chairman, for his excellent work during the past year. —*Joe L. Morris*

Discusses Automatic Screw Machines

Worcester—A report on the election of the ASTE board of directors was made April 7 at a meeting of the Worcester chapter when Richard Smith, newly-elected member of the board spoke briefly on the annual meeting held in Detroit. Delegate E. R. Ljungquist presented a discussion of the meeting of the House of Delegates.

The technical program, "Recent Developments in Automatic Screw Machines," was conducted by C. H. Adams, chief executive engineer, Cone Automatic Machine Co., Inc., Windsor, Vt. He gave an interesting history of the development of turning machines and automatic screw machines. A color and sound film on "Six Spindle Conomatics" was shown to the chapter.

Mr. Adams also related the most recent developments in the field, including cross milling, eccentric drilling and end stamping, with spindle in motion. Results of these operations were illustrated with the many sample pieces on display. The meeting was held at Putnam and Thurston's Restaurant and attended by 50 members. —*Alvin H. Shairman*

The Columbia Tool Steel Mill in Chicago Heights was toured in April by 120 Chicago ASTE members and guests who saw many interesting and recent developments in the making of tool steels. They were welcomed by C. J. Scheid, Jr., vice president in charge of metallurgy. After the tour, the company sponsored a social hour for the visitors. —*R. C. Berliner*

Joseph Crosby Installs Mid-Hudson ASTE Officers

Poughkeepsie, N.Y.—Mid-Hudson chapter's 1953 installation of officers and Ladies' Night were held March 14 at Germania Hall. More than 200 members and their guests attended the combination meeting.

Featured speaker and installation officer was Joseph P. Crosby, first vice president of the Society. In his talk on "Europe's Challenge to the American Tool Engineer," he cited the growth of ASTE since its founding some 20 years ago and gave a few of the highlights of the Society's history.

Serving the Mid-Hudson chapter during 1953-54 are: Stanley P. Cook, chairman; H. J. Tesmer, first vice chairman; R. Fitzgibbons, second vice chairman; F. R. Adams, secretary; and J. H. Keller, treasurer. Heading the various chapter committees are: L. H. Tenney, F. A. Plotnik, C. J. Noll, Jr., E. W. Nielson, T. W. Ristau, C. Morgan Newbury, W. A. Stadtler, R. F. Sanford, H. N. Carlson, E. M. Phalen, and J. L. Petz. The chapter's service award for outstanding work in the chapter was presented to Fred Hennings.

—Edward W. Nielsen

Executives' Night Draws Rockford Members, Guests

Rockford—Nearly 100 members and guests attended the Executives' Night meeting held recently by the Rockford ASTE chapter at the Layfayette Hotel. Coffee speaker was Mr. Dubinsky, manager of WTVO, Rockford's new television station. He related some of the problems encountered in television.

The major address was given by Charles Arps, Allis Chalmers Co., Milwaukee, who discussed "Our Greatest Asset." He elaborated on industry's responsibilities to the community and told about the community projects of Allis-Chalmers.

—Kenneth Hull

Santa Clara Valley members who attended the April ASTE meeting heard a talk on tool steels made by L. V. Klaybor, center, associate director of research, Allegheny Ludlum Steel Corp. Pictured with him are: Chairman William Lanyon, Past Chairman Vincent Diehl, Program Chairman Al Dimond and Secretary John McCarthy.

Lehigh Visits Textile Machine Works

Reading, Pa.—A guided tour through the foundry and machine shops of the Textile Machine Works made up the April program for the Lehigh Valley ASTE chapter. Some 75 members participated in the tour and the social hour which followed.

The foundry is considered the largest gray iron foundry under one roof in the world. It produces on an assembly line basis and utilizes the latest equipment. The machine shop, which covers more than one million square feet of floor space, employs 3,800 persons. Automatic equipment is in evidence everywhere and carbide tooling is used almost exclusively. The shop is laid out for a straight-line flow of material between operations.

All assembly is done on a rolling assembly line capable of producing 80 56-foot long hosiery machines per month. An experimental department where new innovations in hosiery producing equipment is tested is in operation at all times.

The Textile Machine Works produces 75 percent of all textile equipment in the United States and employs a total of 10,000 persons. The ASTE tour was planned by Werner O. Miller, Lehigh Valley vice chairman and chief tool engineer for the company, and Vincent Scalese, chapter secretary and assistant to Mr. Miller at the firm.

—George W. Savitz

Leslie Seager Installs Salt Lake City Officers

Bountiful, Utah—The fourth annual installation of officers' and Ladies' Night was held March 6 by members of the Salt Lake City ASTE chapter. The oath of office was administered by Past Chairman Leslie Seager to: Frederick Preator, chairman; Ray Hogan, first vice chairman; Harry Todd, second vice chairman; Joe Oviatt, secretary; and John Beynon, treasurer.

The program, held at Harry's Dutch Oven, was preceded by a reception and a steak dinner. Entertainment was presented and dancing rounded out the festive evening.

—Reid L. Rice

Leslie B. Bellamy, past president of the Society, administered the oath of office at the March meeting of the Rockford Area chapter. Pictured with him from left, are: Robert Spengler, first vice chairman; Fred Oman, second vice chairman; Walter Fraser, treasurer; Joel Jannenga, third vice chairman; and Ernest Norman, secretary. The service pin was awarded to Walter Fraser for his outstanding work as program chairman. A talk "Our Modern Economy and the Tool Engineer" was made by Mr. Bellamy and heard by about 80 members and guests of the chapter who attended the installation meeting held at the Lafayette Hotel.

Winners of the mechanical drawing contest sponsored by the Elmira ASTE chapter for high school students are pictured with representatives of the firms which sponsored the awards. From left: George Bullen, Remington-Rand; Walter Seyter, Elmira Free Academy; Reese Griswold, Eclipse Machine Div.; Charles Garcznski, Southside High School; Norman Hall, Hardinge Brothers; and John Lindstrom, Ithaca High School.

Bregi Addresses Elmira Chapter Meeting

Elmira—A program on gear shaving and gear finishing was presented at the April 6 meeting of the Elmira chapter of ASTE held at the Mark Twain Hotel. Technical speaker for the event was B. F. Bregi, executive sales engineer, National Broach & Machine Co., Detroit.

Illustrating his discussion with slides, Mr. Bregi described the methods of crown shaving on various types of gears. He conducted a question and answer period after his talk.

A featured part of the program was the presentation of prizes to the winners in the mechanical drawing contest sponsored by the chapter. *—John D. Graham*

Don Wernz Names Executive Committee

Baltimore—Serving on the executive committee of the Baltimore ASTE chapter during the next year are: Thomas Burke and Leon Laux, advisory councilmen; Anthony Fria, advertising; Ernest Russell, constitution and bylaws; Clifton Kelley, editorial; William Schukraft, education; George Andrews, entertainment; James Rogers, membership; Harry B. McCaslin, professional engineering; Roy Pajarinen, program; Walter George, public relations; and Neil Heller, standards.

At the chapter's April meeting, William A. Williams, consulting engineer from Philadelphia, gave a talk on the history of power transmission. Slides illustrated the lecture.

The program also included dinner, a report on the annual meeting by Leon Laux, and a movie on missile research by the armed forces. *—Clifton Kelley*

ASTE Members Tour A. C. Wickman Co.

Toronto—More than 130 members and guests of the Grand River Valley chapter met April 17 at the A. C. Wickman Co. for a plant tour to see the manufacture and finishing of Wickaloy tools, optical inspection and Precisionaire gaging equipment.

The group, welcomed by Buehl Manning of Wickaloy, toured all phases of manufacture from the reduction of the components in rotary pulverizers, through press forming, sinterizing, roasting, grinding, assembly by induction brazing and actual production.

A lunch was provided in the cafeteria after the tour. At the business portion of the meeting, Roy Robertson was named to the post of chapter secretary which had been vacated by the transfer of the original officer. A motion picture on projection methods of inspection rounded out the evening's program. *—W. C. Little*

Wichita Members Hear Quality Control Expert

Wichita—Past chairman pins were presented to four members of the Wichita chapter of ASTE at the April 8 meeting. Recipients were Orville Strahm, Harold Bales, E. Pitsch, and William Grabendyke.

The technical speaker for the program was Charles J. Hudson, representative and retired quality control manager of the Norton Co., Worcester, Mass. Mr. Hudson is a founder of the American Society for Quality Control and is currently chairman of its Worcester Section. He is responsible for the development of the vertical spindle mixing machine used in the manufacture of grinding wheels, specially bonded abrasive wheels for grinding crankshafts, and the present day statistical quality control methods at Norton Co.

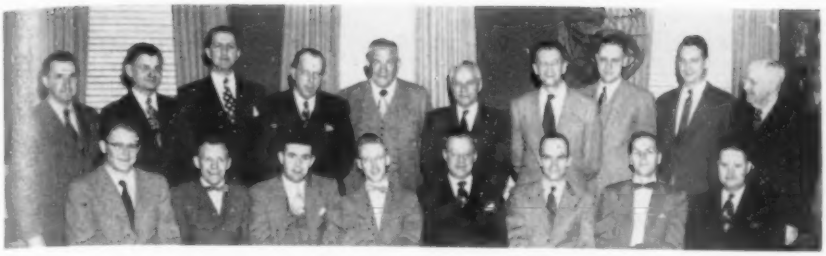
For his address at the Wichita meeting, Mr. Hudson traced in detail the various steps necessary in the selection of abrasives and bonding agents. He explained the mixing and molding problems and described how high temperatures and pressures and the use of new materials have improved grinding quality in industries ranging from dentistry to metal, glass and woodworking.

—John Temple

Joseph Crosby Installs Mohawk Valley Officers

Oriskany, N.Y.—Nearly 70 members and their guests were on hand for the installation meeting of the Mohawk Valley chapter held March 24 at Trinkaus Manor. The ceremonies were conducted by Joseph P. Crosby, first vice president of the Society, who gave a discussion on the importance of tooling to the welfare of the nation. Entertainment was provided by Burt D. Hawks, principal of Kernan Public School in Utica, N.Y. *—Ray Hurley*

More than 200 members and their wives turned out for the Ladies' Night sponsored April 17 by the London-St. Thomas District ASTE chapter. The party was held at the Town and Country Club in St. Thomas and provided an enjoyable program of dancing and entertainment. Corsages and plants were given to the honored guests. The smiles pictured here indicate that a wonderful time was had at the annual affair. *—F. W. Lewis*



Pictured at a recent meeting of the Hartford ASTE chapter, front row, from left, are: John Hand Conard, Grant W. Smedley, Robert Gay, Omer A. Gingras, Edward T. Ross, Harry Anderson, Paul E. Dillberg and Owen C. Stevens. Back row: Francis H. Peoguin, Henry E. Kuryla, A. Douglas Proctor, Ernest F. Osterling, Ray H. Morris, Michael B. Elin, Fred H. Fippinger, Robert G. Strauss, Arnold C. Lamore and Jesse T. George.

ASTE Program Features Speech by Fred Lucht

Philadelphia—The featured speaker at the April meeting of the Philadelphia chapter was Fred W. Lucht, engineer with the Carboloy Dept., General Electric Co., who discussed "Gun Drilling and Trepanning." The program, sponsored by the chapter's Carbide Group, was attended by 200 members and guests.

The essential components of the gun drilling tool are the cutting edge, usually carbide, which extends radially from the OD to the center, and two wear strips located approximately 90 degrees and 180 degrees behind the cutting edge. Means are provided to channel high pressure oil to the cutting edge and to carry oil and chips back to a filter. Mr. Lucht mentioned the Franz permanent magnet filter as being an effective device for removing minute metal particles from the fluid which otherwise would cause excessive pump wear.

A number of interesting case histories were discussed involving such materials as stainless steel, titanium and other hard-to-machine alloys. Mr. Lucht said the application of gun drilling and trepanning should be expanded to include shallow depth holes. Advantages would be accuracy in size and parallelism, excellent surface finish, long tool life, and saving of time.

A preliminary film on the benefits derived through the investment of savings into common stocks was shown before the technical program. More than 80 members and guests attended the dinner and the evening program drew an attendance of 200.

Bernard Better Addresses Kansas City ASTE Chapter

Kansas City, Mo.—The problems encountered in the development of a tap driving device were discussed April 1 at a meeting of the Kansas City ASTE chapter when Bernard Better, director of research for Scully-Jones & Co., addressed the group. His subject, "Production Tool Development," also covered various problems which arise when using the tapper with different materials. The meeting at Roselli's restaurant was attended by 50 members and guests. *—Richard W. Corliss*

Tells How to Get More Out of Turret Lathes

Welland, Ont.—Technical speaker at the April meeting of the Niagara District chapter was Roger E. Bitner, sales engineer with Warner & Swasey Co., Cleveland, who covered the subject "How to Get the Most out of Your Turret Lathe." He stressed the importance of selecting the right size machine for each particular job to produce parts most economically, and said costs can also be lowered by using special tools for the turret lathe.

About 70 members and guests were present for the meeting which was held at the Barclay Hotel. Williams & Wilson, Toronto, were hosts for the evening. Albert Clarkson, chapter chairman, presided. Cy Mitchell introduced the speaker. *—William A. Yaeger*

Evansville Awards Student Memberships

Evansville—Five outstanding industrial engineering students at Evansville College were awarded student memberships in ASTE at the April 13 meeting of the Evansville chapter. The presentation at Hadi Shrine Temple was witnessed by 75 members.

Program speaker was Halsey F. Owen, professor of manufacturing processes at Purdue University, who spoke on the advantages and requirements for being a registered professional engineer. His discussion was followed by a question and answer session, with Charles Thuman, chairman of the chapter's professional engineering committee assisting. Mr. Thuman announced that preparations are underway for a refresher course to be offered at Evansville College with the help of the Purdue University Extension Service.

—William Gaines

Binghamton officers for 1953-54 were installed at the March meeting. Standing: David O. Williams, first vice chairman; Philip M. Taylor, second vice chairman; Wendell Harper, secretary; and Andrew Komar, treasurer. Seated: William Liendecker, past chairman of the chapter, and Howard D. Bertholf, present chairman.

Nearly 100 members and guests of the Evansville chapter were on hand March 9 for the installation meeting. Standing: Henry Pernicka, retiring chairman; John Race, second vice chairman; Carl Doughty, secretary; Seated: Russell Wibig, treasurer; Arthur Ullman, first vice chairman; and Paul Vierling, chapter chairman.

Neklutin Discusses Automatic Machines

St. Louis—To better acquaint St. Louis ASTE members with the great variety of manufacturing industries in the St. Louis area, the chapter's program committee is making a special effort to enlist outstanding men in these industries to present the technical portions of the programs.

One of the most recent speakers was C. N. Neklutin, vice president in charge of engineering for the Universal Match Corp., Ferguson, Mo., and its subsidiary, the Ferguson Machine and Tool Co. Mr. Neklutin opened his address on "Dynamic Forces in Automatic Machines" by pointing out that the efforts of most engineers at the present time

C. N. NEKLUTIN

are devoted to the refinement and speeding up of already existing machines, tools, and methods. He channeled this thought into the designing of automatic machinery incorporating cams and reciprocating motions and the manner in which vibrations affect the stresses present in machine parts.

Through the use of slides showing charts and mathematical formulas, Mr. Neklutin showed how it is possible to design motions whereby a vibration is killed before the next motion is started, in order to prevent a build-up of vibrational stresses which would be disastrous to the action and life of the machine parts and the machine.

There were 124 persons for dinner and a total of 180 members and guests present for the business of this April 2 meeting held at the Hotel DeSoto. Before the major speech, Chairman Willis J. Potthoff, who was a delegate to the ASTE Leadership Conference, reported on the week-long meetings and activities at the conference.

—E. Graser

Speaker at the family night meeting of the Peoria chapter was William Skadden, third from right, lecturer and writer. With him are: Mr. and Mrs. Duane Brighton, Mrs. Skadden, Mrs. Ray Zimmerman and Mr. Zimmerman.

Milwaukee Chapter Tours Globe Steel Tube Co.

Milwaukee—The Globe Steel Tube Co. was host April 9 for a plant tour by more than 200 members and guests of the Milwaukee ASTE chapter. Guides were provided for groups of 20 men which visited the steel storage yard, shear house, research laboratories, plug mill, rolling mill, and reeling, reducing and finishing mills. ASTE members also witnessed the complete cycle of tube manufacturing at the company.

After the tour was completed, each visitor was given a special folder on tube manufacturing and a text on metallurgy of iron and steel written by K. Ihrig.

—Walter Behrend

Successful Living Depends on Attitude

Peoria, Ill.—Adressing the April 2 meeting of the Peoria ASTE chapter, William Skadden, noted lecturer, writer and philosopher, said that chronological age of an individual is as important as the spirit and vim with which he meets life's situations and problems. He urged his audience to "be able to receive and absorb things, but less emphasis on manipulating and more on compromising, sharing, and cooperating with families and fellow workers."

Toastmaster for the evening was Duane H. Brighton. The family night meeting held at the Hotel Pere Marquette, was attended by 150 members and guests.

New members of the chapter are: August Lauterbach, Frank Maras, William Sherman, Richard Burgard, John Bach, Raymond Buckman, Robert Fletcher, Larry Meyer, Robert Opperman, Richard Van Rossen, and Richard Winkler.

—Russ Saurs

Peterson Installs Lima ASTE Officers

Lima, Ohio—Raymond C. W. Peterson, national secretary of ASTE, was the installing officer at the March meeting of the Lima chapter of the Society. Sworn into office for the coming year were: A. E. Feightner, chairman; R. E. Fromson, first vice chairman; H. W. Carey, second vice chairman; W. J. James, secretary; and J. E. Kuck, treasurer. Chairman Feightner presented R. J. Schimpf with the chapter's first past chairman's pin.

The guest speaker was L. C. Scheafer, assistant manager of industrial engineering, Westinghouse Electric Corp., who addressed more than 70 members and guests attending the session. He reviewed his recent trip to Europe where he visited a number of small motor plants.

—Donald Cox

National President Roger F. Waindle congratulates Harry Swanson, chairman of the Western Michigan ASTE chapter, at the March installation meeting. Other officers shown, from left, are: Charles Bonczyk, first vice chairman; Robert Stockreef, second vice chairman; Arthur Cook, secretary; and William Bylsma, treasurer. Seated: G. A. Ingald, guest speaker; Dale H. Burke, area membership captain for ASTE; and Robert Maguire, retiring chairman of the chapter. The meeting was held at the Rowe hotel.

Martin Discusses Hydroforming of Parts

Indianapolis—Kenneth P. Martin of the Cincinnati Milling Machine Co. addressed about 120 members and guests of the Indianapolis chapter at their April 2 meeting held at the Sahara Grotto. He spoke on "Hydroforming of Parts."

With this method of forming for low cost tooling, diameters can be held to 0.001, the number of operations in multiple-forming can be cut in most cases, and labor and tooling costs can be reduced.

The meeting was conducted by Joe Penn, chapter chairman, who introduced committee chairmen and assistants who were not present at the March meeting.

—N. B. Rosenbarger

Louis Joliet Members Hear About Arc Welding

Joliet, Ill.—A group of 99 members of the Louis Joliet ASTE chapter met April 21 in the Terrace Room of the Woodruff Hotel to hear a talk by Omar Blodgett, sales engineer of the Lincoln Electric Co. He spoke on the applications of arc welding. Technical chairman was Lionel Rohman and moderator was Harry Moffatt, chapter chairman.

At the March meeting, S. A. Brandenburg, vice president of the Monarch Machine Co., spoke on the latest developments in the turning field. Robert Gomien acted as technical chairman and First Vice Chairman Don Stanfield was the moderator. Two guests from the Fox River Valley chapter were present for the session, Chairman Phillip Shaner and Charles A. Olsen, secretary.

Heading the committee of the Louis Joliet chapter for the next year are: Melvin G. Burdett, program; Nicholas Salamon, public relations; Cliff Berglund, editorial; Elmer Dixon, education; Kenneth C. Hanks, membership; Roy T. Crady, standards; Ralph L. Reynolds, constitutions and bylaws; and Willard Bossert, historian and records committee.

—M. G. Burdett and H. E. Freier

West Coast News

By Andrew E. Rylander

During last month I paid a long-deferred visit to Production Engineering in Berkeley, where they made the Shopsmith and the Magna drill. Between Paul Daun, production manager, and Ted Lindquist, manager of production service, got a good insight into what makes the Shopsmith tick. Sure, it's a hobby shop gadget and one of the most versatile of its kind, but it's made to standards of quality that would do credit to a precision-made machine tool.

Speaking of machine tools, they are defined as machines that can reproduce themselves. Well, practically all of the special machines used for manufacture are made up from Shopsmith and Magna components, such as drill heads in particular, and there they are at work making other components like the proverbial mud going through a tin horn. And good, what I mean!

Attended Golden Gate's April meeting, held a Rickey's which the meeting announcement placed at No. 3 Stonestown, near Ocean and 19th Avenues. So I looked up Ocean & 19th on the San Francisco map and got there to find that "near" was a couple of miles away. And what a place! Stonetown's post-war development of fine apartments and one of the finest shopping centers anywhere, even bigger and better than Walnut Creek's.

During the general handshaking, Ch'man Dave Gustafson relayed greetings from Detroit. Was particularly happy to get a greeting from Hartley Barclay, although I've been following him pretty regularly in the New York Times. A regular guy.

During the dinner, listened to an erudite across-table discussion on heat treating brazed steel—as with Sil-Flo—between Ben Berlien and Handy and Marman's R. J. Lafferty. One always learns by listening. Speaking of the dinner, it was tops—the best I've partaken of at any ASTE meeting, annual banquets possibly excepted. Topping that with a good Pratt & Whitney cigar donated by Ted Rohrer, sat back to hear Allegheny Ludlum's L. V. Klaybor talk on "Selection and Use of Tool Steels."

I've always contended that the interest in a talk is best evinced during the questions and answers period. And there, they'd probably have kept the speaker on his feet until the sma' hours only he had to catch a plane.

He had addressed Santa Clara Valley chapter the previous evening, with equal response, apropos which he is making friends on his tour. As for Santa Clara Valley, that up 'n' coming chapter has lost 1st Veep G. B. Randolph through transfer to Stockton, a step-up in the ranks of Republic Supply Company by whom he is employed. Keep your eye on that boy; he's a comer!

From one thing to another, the Golden Gate Educational Com'tee is trying to lure me back to teaching, the idea being start a class in advanced tool engineering this fall. Well, I can't take it with me so might as well pass it along—the Bd. of Education willing. We'll see.

All right, so far good. The meeting over, I started for home via what was supposed to be a short cut to downtown San Francisco but turned out to be a dizzy whirl of winding parkways that just got nowhere. Cloudy, so no stars to guide me and no moss on the lamp posts to show north and south. Somehow found myself on the Bay Bridge, where I was glad to hand over my two bits toll charge. Like I've said before, San Francisco is certainly one mighty interesting city.

This group of senior high school and junior college students along with Peter Carter, Bryon Yount, Harold Addy and Dick Hirsch of the San Gabriel Valley chapter attended the Metals Show at the Pan Pacific Auditorium on March 27. The visit was planned to stimulate interest in tool engineering among the students with the hope that their schools will equip laboratories, machine shops and specialized drafting rooms. At the April meeting the chapter heard a talk by L. V. Klaybor of Allegheny Ludlum Steel Corp. —*Peter Carter*

W. H. Richter Addresses Fox River Valley Meeting

St. Charles, Ill.—Meeting at the Baker Hotel on April 7, more than 70 members of the Fox River Valley ASTE chapter heard a talk by Winston H. Richter, branch manager of the plastics division of Monsanto Chemical Co., Chicago. He spoke on different types of plastics, methods of fabrication and their applications in modern industry.

Chapter Chairman Phil Shaner reported on the annual meeting and Leadership Conference held in March at Detroit. —*D. E. Zierk*

Hobbing Procedures Topic for Rochester Program

Rochester—Islyn Thomas of the Newark Die Co. spoke to members of the Rochester chapter at their April meeting on "Hobbing Procedures and General Mold Design and Construction." Slides were used to illustrate his discussion of the advancements in the art of hobbing.

Edmund Spitzig of the same firm, assisted Mr. Thomas during the question and answer period by reviewing hobbing techniques. He stressed the importance of using the correct tool steel for the master hob and blank.

—*Paul Bruno*

Speaker at the April meeting of the San Diego chapter was Tom Kenkel on N.T.H. Products, El Cajon, Calif. He talked to 85 members on roll forming of metal. Chairman A. E. Crom gave a brief speech on the annual meeting and Leadership Conference held in Detroit.

—William Keller

Binghamton Members Hear Frank Clark

Vestal, N.Y.—Frank Clark, secretary and treasurer of the Van Keuren Co., Watertown, Mass., was the technical speaker at the April meeting of the Binghamton chapter held at the Vestal American Legion Hall. His program topic was "Measuring in Millionths by Use of Optical Flats."

A short sound film was shown to augment his talk and demonstration. A question and answer period followed the discussion. —*Charles L. King*

W. B. Peirce, past president of ASTE, installed the new officers of the Pittsburgh chapter at the March meeting. From left: Fred Hennig, retiring chairman; Mr. Peirce; Larry J. Brozek, chairman; Ellwood Weissert, first vice chairman; Robert S. Mason, second vice chairman; J. L. Sullivan, treasurer; and H. W. Bray. Technical speaker for the program was E. J. Pavasic, Lindberg Engineering Co., Chicago, who presented a talk on "What's New in Heat Treating." More than 130 members and guests attended the meeting which was held at the Sheraton Hotel.

Program speaker at a recent meeting of the Saginaw Valley chapter was Robert E. Reed, center, senior project engineer, Allison, Div., General Motors Corp. Shown with him are Don McMillen, chapter chairman, and Charles E. Bierwirth, secretary and program chairman for the evening.

Seattle ASTE Officers Past Chairman Installs

Seattle—Newly elected officers of the Seattle chapter of ASTE were installed March 24 at a meeting held at Irvings' 620 Club. The ceremonies were witnessed by 85 members and guests. Taking office were: Roy A Coady, chairman; A. R. Jones, first vice chairman; Frank Stasny, second vice chairman; Harvey Buffum, secretary; and John Bodner, treasurer. They were installed by Harold Pinkerton, past chairman of the chapter.

Seattle member John Buckingham, right, was awarded a Tool Engineers Handbook for winning the chapter's membership contest. Louis Butler, chairman of the membership committee, made the award.

Mr. Coady presented his report on the annual meeting and Leadership Conference held in Detroit in March. A talk on advances in alloy steels and high-speed cutters was made by William Fraser, chief metallurgist for Union Twist Drill Co. —*Carl R. F. Carlson*

Klaybor Speaks on Use of Tool Steels

San Francisco—New committee chairmen of the Golden Gate chapter were introduced by Chairman David A. Gustafson at the April meeting. The evening's program also included a good fellowship hour, dinner and technical talk. About 130 members and guests attended.

L. V. Klaybor, associate director of research, Allegheny Ludlum Steel Corp., presented a discussion on the selection and use of tool steels. His talk, illustrated with slides, emphasized the metallurgical composition of the principal tool steel grades and the development of specific qualities through combinations of alloying elements.

—*Philip R. Freeman*

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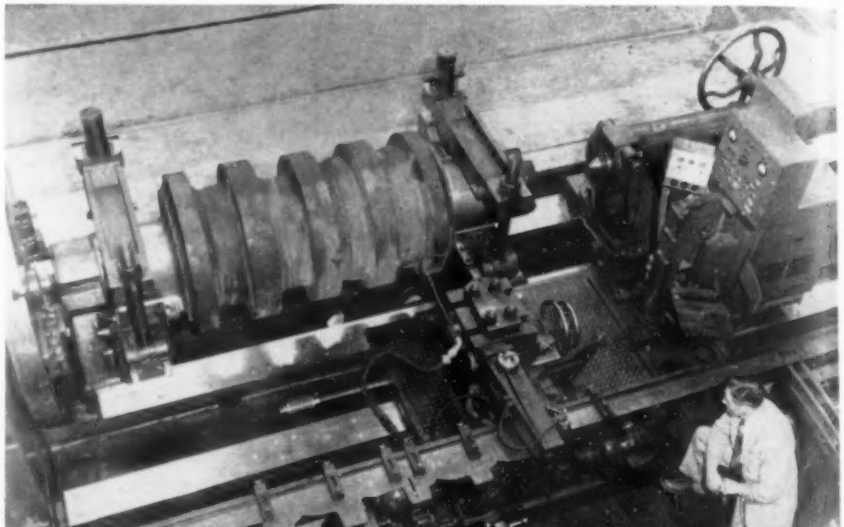
News in Metalworking . . .

MAMMOTH LATHE GIVES AUTOMATIC DUPLICATION

Fully automatic contour duplication was accomplished for the first time on a machine the size of the giant roll-turning lathe recently installed at U. S. Steel's Homestead, Pa., roll shop.

All electronic equipment controls the tool's cutting action. In operation the duplicating device guides the motion of the cutting tool from a flat template whose contours are exactly those of the roll to be machined. A floating tracer stylus moving along the edge of a template signals any varying degree of angular deflection to a control panel. These signals are electronically amplified, interpreted and fed to two electric motors, whose combined action in response to the signals keeps the stylus traveling and hugging the template. Since the cutting tool is mounted on the same movable part of the lathe carriage as the stylus, tool travel duplicates the path of the stylus. This works an advantage since once a job is set up, the lathe operates with a minimum of operator supervision, duplicating on the roll.



the contours of the guiding template. Compensation for tool deflection can be made during lighter, finishing cuts.

Another first for the equipment is that it is used to generate on huge steel mill rolls the complex body outlines which produce beams, channels, ship sections and other rolled steel products.

The electronic control, in fact, gives the lathe another major advantage, due to the flexibility of its control system, and the ease with which it is maintained. Push-button manual control of all motor-driven tool feeds permit fast roughing on individual passes and rapid automatic roll finishing.

WELDING PAPER CONTEST

Eutectic Welding Alloys Corp. has announced the rules for this year's competition which is again open to engineers, metallurgists, welders, students and others qualified.

Additional emphasis in the 1953 competition, however, has been placed on papers of a more technical nature and the scheduled $2000 in cash awards have been revised to provide greater regard for entries in that category.

As in other years, a second category has been established with $550 in cash awards for "Practical Welding Applications." Closing date is August 31.

Rules and information helpful to the contestant, may be obtained from Eutectic, Department P, 172nd St. and Northern Blvd., Flushing 58, New York.

NEW CONTROL SYSTEM TO REPLACE PLAN GOVERNING MANUFACTURING MATERIALS

As of July 1, 1953, the Defense Materials System will replace the Controlled Materials Plan which at present governs materials in the manufacturing industry.

Under the new Defense Materials System, the defense programs identified by the symbols A, B, C, D and E (military and Atomic Energy Commission orders) will be carried out under DMS Regulation 1 (production) and DMS Regulation 2 (construction).

According to the system, producers of controlled materials (steel, copper, aluminum) may accept unrated orders for delivery after June 30 this year. Each producing unit, however, will be required to reserve a specified portion of its production for defense orders in accordance with NPA directives.

The portion of the directive probably of most concern to manufacturers of machine tools (designated Class B products) is that those who receive orders bearing A, B, C, D or E ratings will be authorized to self-assign the B-5 symbol to their purchase orders for materials required to produce such rated orders. It is no longer necessary to apply for allotments on Form CMP-4A or its successor DMS-4A which is still required for producers of Class A products.

DMS Regulation 1 provides that manufacturers who are unable to obtain supplies for maintenance, repair and operating purposes needed to fill rated orders are permitted to self-assign the rating DO-D-9 to obtain them. In addition such ratings shall show the calendar quarter in which delivery is required.

Another leniency is that manufacturers of Class B products, being permitted to self-allot, shall pass on to manufacturers of Class A products (subcontractors who cannot self-allot) "related" allotments deducted from their own self-assigned allotments. This shall specify the quantities and kinds of controlled materials such as carbon, alloy or stainless steels, copper and aluminum, and shall carry with it an allotment number identifying the program and suffix indicating the quarter in which delivery is required.

Specific sections of the directive dictate that no more than 40 percent of the quarterly requirements may be received in each of the first two months of a quarter.

If a subcontractor is allotted too much, he must return the excess to his prime contractor, and if too little he must apply to his customer for an increase.

All authorized controlled materials orders shall have equal preferential status and shall take precedence over other orders for controlled materials to the extent provided in NPA orders affecting the case.

During the transition period, orders for controlled materials as of March 23 for delivery after July 1, must be placed under Controlled Materials Plan. All outstanding allotments for controlled materials for the third and subsequent quarters are cancelled with the exception of those for nickel-bearing stainless steel.

Machine tool builders should immediately apply a DO-B 5 rating to his outstanding orders (for delivery after July 1) to the extent that he has orders for machine tools bearing A, B, C, D and E ratings.

Third quarter allotments for stainless steel are still valid, and may be used by applying the rating "SS-3 Q 53."

All ratings except those bearing the prefix A, B, C, D or E, B 5 and DX are cancelled as of July 1.

Orders scheduled for but undelivered in the second quarter retain their ratings and preferential treatment in the third quarter.

Producers of controlled materials may now accept unrated orders for delivery after July 1.

Records of all transactions covered by this regulation must be kept for at least two years.

METAL FASTENING BY SELF LACING

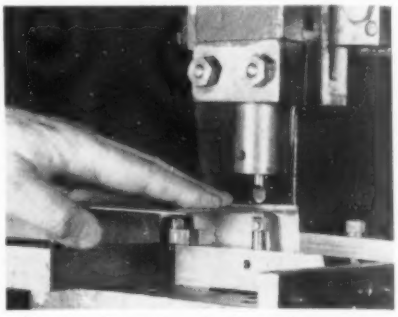
A form of metal fastening has been introduced to the industrial world which is not only hailed as revolutionary, but may become one of the most important methods of joining and fabricating sheet metal. In effect, sheet metal is "buttoned" together by a simple one-step operation.

Known as "Williams Metalacing," the process essentially involves a punch and die which through shearing action makes a parallel double incision in the two sheets of metal to be joined. Metal between the incisions is rammed downward against the anvil of the die beneath the sheets and between that die's movable jaws. There the force of the impact spreads the depressed metal sideways, forming a permanent fastening wedge or button under the surface of the bottom sheet.

Reports from industrialists who have examined the method indicate that its most impressive advantage is speed. An example of this was in the Otis Sheet Metal Works, where the method was initially shown this spring. Eric Skovgaard, co-owner of the Works estimated Metalacing could cut at least four hours' work from a 16-hour job his shop had to do. The order required a 14-gage continuous steel hinge to be riveted to 12-gage hot rolled steel plate. The timed result was completion in eight hours. The task previously was double that time. Reason for accomplishing the job in so unexpectedly short a time is the fact that the one-step Metalacing was substituted for punching, matched drilling, alignment and realignment and final riveting.

In addition to economy of time and labor, several other advantages are emphasized of the process. Primary among these is the fact that there is no interference with subsequent reworking, sawing etc., since the fastening is part of the parent metal itself and does not involve an additional element as do other methods. Further, the rectangular form of the Metalace fastening eliminates the possibility of pivoting, which sometimes happens with rivets or bolts. Yet another favorable feature is the fact that a Williams punch and die insert can convert any punch press to this type operation.

The method was invented by Ivan A. Williams, a mechanical engineer who was working on the problem of forming an identation in metals to prevent their sliding apart.



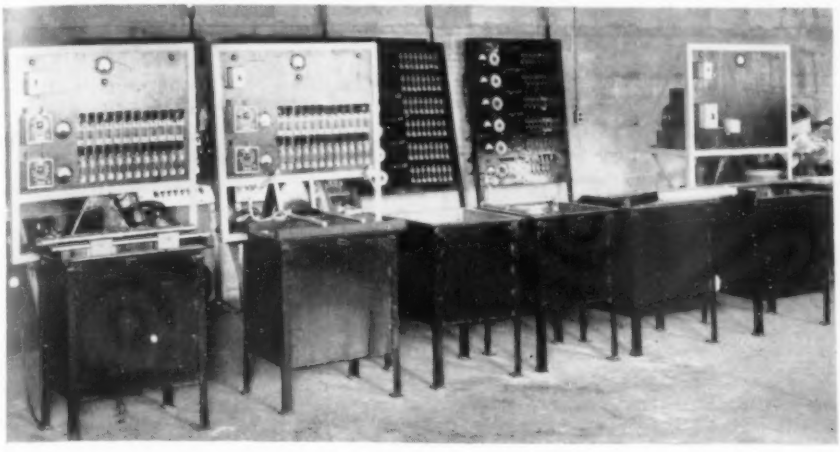
Above. Operator is fastening ornamental edge molding to sheet aluminum with the yieldable die and special punch inserted in an ordinary punch press.

Below. Top and bottom views of Metalaced sheets of galvanized sheet steel 1/32 inch thick. Actual dimensions of these Metalaces are 1/16 inch wide by 3/16 inch long.

Later study showed that elaboration of the indentations could form a permanent fastening. A number of years, then, were required to develop and perfect equipment, which was tried in production at several factories in the Portland area.

Thus it was only recently the project was considered completed, and arrangements were made with Rotex and Crockatt Engineering Co. of San Francisco to license the method under patents granted Mr. Williams.

Tools of Today . . . .



Chrome Plating Unit

The Chrome Electro-forming Co., 7515 Lyndon Ave., Detroit 21, has perfected a chrome plating unit, completely automatic in operation, which will hard chrome plate to blue print tolerances.

Closer control of plate thickness often eliminates succeeding grinding operations. Tolerances are held as close as 0.0001 inch on outside and inside diameters. In normal chrome baths, the throwing power is usually about 16 percent. With the Morey Process, this has been increased to 77 percent, according to the maker. Using this process, it is possible to add as much as 0.001 inch plate to the pitch diameter of threaded plugs and ring gages while maintaining perfect thread form and without developing taper. The plate is extremely dense and close-grained with a Brinell hardness from 1150 to 1250.

Chrome form plating units will plate from ½ to 100 sq inches of surface area with an inside diameter up to 10 inches and an outside diameter up to 12 inches. It is not necessary to etch the parent metal before plating. The parent metal is penetrated as much as 0.0001 inch for bond. This makes it possible to duplicate the finish found on the parent metal even down to ½ microinch.

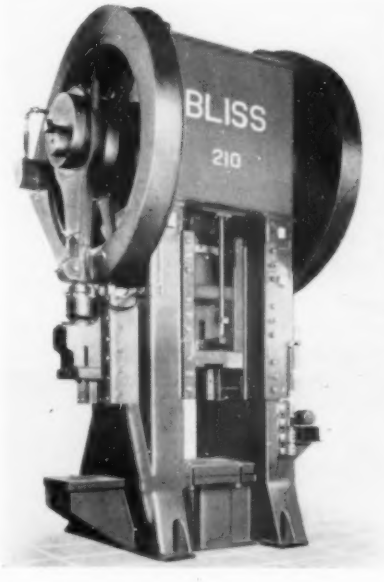
The automatic unit is easy to operate so that an operator can be trained in about two weeks to do size plating. It is heated by two quartz immersion electric heaters of 1500 watts each. These heaters will heat to 1250 F in one hour and 45 minutes, room temperature. They are thermostatically controlled to plus or minus one degree F. The unit has a tank capacity of 41 gallons, 100 lb chromic acid.

For electrical calibration there are two ammeters ranging from 0 to 100 amps with a combination of 12 switches for each ammeter. A voltmeter and shunt are also included. Timing is by two clocks ranging up to 60 minutes. A white light shows the station in operation while a red light indicates that the work is finished. Power source is a 200-amp rectifier with switch and starter box. **T-6-1111**

Trimming Press

Development of a line of trimming presses, featuring the streamlined box-type crown construction, is announced by E. W. Bliss Co., Canton, Ohio. These presses are especially designed for rigidity and quietness of operation.

The single-geared presses in the line are of four-piece frame welded steel construction with twin heerringbone driving gears running in oil and equipped with rim-type, oil-tight gear guards.

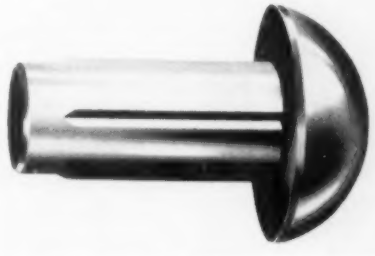


Among the features of the Bliss No. 210 trimming press are an air counterbalance concealed in the uprights, automatic lubrication and the Bliss fast-acting, cool-running friction type clutch. Another feature of this press is the friction clamp slip-type knockout which prevents accidental breakage of dies, or other parts, by permitting the friction clamp to slide on the knockout bar whenever the bar has not been adjusted to the proper height.

The press operates at a speed of 35 strokes per minute with ram capacity of 440 tons. The slide has a 16-inch stroke with a motorized adjustment of six inches, and the trimming attachment has a 10-inch stroke with a 4-inch adjustment. The press is 18 feet high, has floor space requirements of 94 x 86 inches and weighs approximately 98,000 lb. **T-6-1112**

Stud Fastener

The Driv-Lok stud, designed to speed the attachment of light metal or plastic parts such as name plates, covers, brackets, etc., to heavier structural members, has recently been introduced by the Driv-Lok Pin Co., 715 Chauncey St., Sycamore, Ill.



Requiring but light blows to drive the stud and secure the parts, the fasteners are resistant to shock and vibration, yet can be easily disassembled without damage to the components.

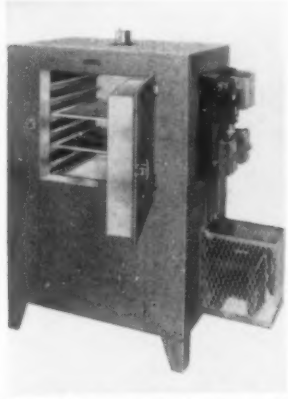
Three parallel grooves, equally spaced are impressed on the shank of the stud, displacing a carefully determined amount of metal to each side of the cut to form a raised flute. When the Driv-Lok stud is driven into a hole of the same nominal diameter as the shank, the flutes are compressed against the whole wall, holding the stud securely in place.

Available in round, flat and countersunk head styles in lengths (under head) from ⅛ to ½ in. and shank diameters from 0.067 to 0.250 in., Driv-Lok studs offer many advantages in time, labor and material savings. **T-6-1113**

Cabinet Ovens

A line of cabinet ovens for closely controlled production and laboratory use makes possible closer control of uniform temperature, better performance and greater economy of operation.

These ovens are equipped with a high-pressure motor-driven blower which propels heated air in a definite air-flow pattern through the work chamber. This prevents any disturbance due to radiant heat and assures temperature uniformity.



Other features include indicating temperature control; high volume adjustable air-flow; high and low heat switch for close control and quick recovery; Inconel-sheathed heating elements; manual interlock for purge period operation of blower without heat; electrical interlock for turn-off of heat in case of blower motor failure; adjustable, positive exhaust and intake.

Shell construction is 18 and 20 gage oven steel reinforced and welded. Insulation is Fiberglas. Exterior finish is grey wrinkle; interior is 1000 degrees silicone aluminum paint.

They are available in either horizontal or vertical flow for temperatures to 650 and 850 F for 220 or 440-volt operation. Further details may be had by writing Grieve-Hendry Co., Inc., 1811-19 W. Lake St., Chicago 12. **T-6-1121**

Gage Blocks

The Fonda Gage Sales Corp., 38 Broad St., Port Chester, N.Y., is offering a complete line of square gage blocks.

With the inclusion of these Fonda square blocks, the Company is now able to supply both types of blocks, square and rectangular, in all three materials, i.e. steel, carbide and chrome carbide.

Quick identification on this square block is accomplished by numbering on a ground band located on the sides of the larger blocks and, on the smaller blocks, etching near the edges of the gaging surface, the center section being left clear for comparator use. **T-6-1122**

Immersion Heater

A heavy duty steel sheated immersion heater for alkaline bath heating has been announced by the Cleveland Process Co., Cleveland.

According to the manufacturer, The Cleco-Glorod series W immersion heater is designed for sage operating temperature of the nickel alloy resistance element which is covered by a quartz body, claimed to be the most uniform and efficient protective conductor of heat. This permits longer service life. Low heat density protects both heater and liquids from damage due to carbonization of frying.

A sealed, vapor-proof Underwriter's Approved junction box prevents entrance of liquids and vapors. When controlled by a thermostat, units are in operation only for the period of time required to maintain the desired bath temperature.

Units are portable, a single unit can serve many tanks and be quickly mounted over the side of the tank, or as in the case of vapor degreasers, screwed into 2 inch threaded holes in the bottom of tanks.

The manufacturer also states that this new series W heater increases efficiency and economy because units are immersed directly in liquid to provide heat only where needed.

This heater has proved successful in high alkaline solutions and copper cyanide plating baths. The heater can also be used in vapor degreasers and for heating alkaline plating baths such as brass, bronze, cadmium, gold and silver.

It is also available with a brass sheath for maintaining constant temperature water supply.

The heavy duty W series heaters are available as dual voltage, 230 and 460-U, single-phase, in capacities of 1000, 2000, 3000, 4000, 6000, and 10,000 watts overall lengths ranging from 14 to 70.

T-6-1131

Piercing Punch

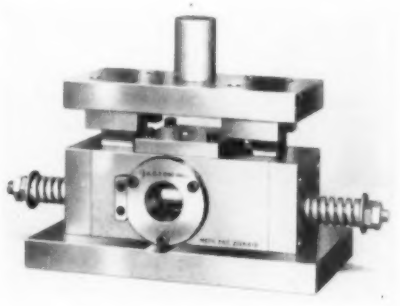
The design of this piercing punch is said to give the same head strength, but makes possible better concentricity. They are made of vanadium tool steel, uniformly hardened and ground to meet rigid concentricity tests. They have a Rockwell C hardness of 59-61. In assembly the punch is snapped into the retainer and the retainer then doweled and bolted directly to the die set.

Made by Ring Punch and Die Co., 108 Foote Ave., Jamestown, N. Y.

T-6-1132

Tube Notcher

The time required for notching pipe and tube ends has been reduced to less than three seconds according to the announcement of a Vogel Arc-Fit pipe and tube notcher. This tool, for use with a punch press, notches both sides of the pipe end with a single stroke of the press. When tubing is fed into the die,



the die punch goes inside the tube end. As the press ram comes down, the punch is driven laterally to notch one side of the tube end, then immediately in the opposite direction to notch the other side. Cutting is from the inside out, leaving clean edges that require no further finishing. Perfect alignment of the notches is automatic. The time required is stated to be only two to three seconds for the double notching. This tool is called the Twin-Notch Arc-Fit to distinguish it from the standard Arc-Fit which cuts one notch at a time in pipe and tubing ends. Interchangeable dies, punches and spacers make it adaptable for notching ½ to 2-inch pipe and tubing. For further information, write Vogel Tool and Die Corp., 1807 N. 32nd Ave., Melrose Park, Ill. **T-6-1141**

Bench Legs

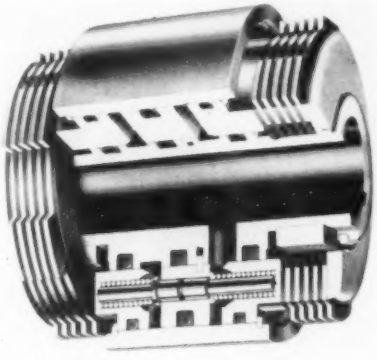
With the availability of steel bench legs in various styles, shops can build benches to suit their particular needs. Developed by Industrial Bench & Equipment Mfg. Co., Inc., 97 South St., New Britain, Conn., from formed sections, electrically welded throughout, to provide stiffness and rigidity. There are no bolts to work loose.

These bench legs are rigid enough after the bench has been constructed not to need the support of a wall to retain stiffness. Underneath shelf and bin construction can be installed without danger of disturbing the rigidity of the bench. Entire bench can be readily moved to another location without loss or damage. Steel bench legs are available in single, double or wall types. All types of legs are designed to construct benches free from end sway or wall support. All welding is guaranteed. **T-6-1142**

Clutch

The Twin Disc Clutch Co. of Racine, Wis. and Rockford, Ill. has announced an oil-actuated multiple plate clutch, offering a standardized oil applied clutch for general industrial use.

The clutch, available in model MOS (single) and MOD (duplex), is designed to provide such specific features as no-adjustment, higher, more constant torque capacity, more compactness, adaptability to remote control, and longer wear life.



The obvious advantage of the oil-actuated clutch is that no adjustment is required to compensate for friction plate wear, since the floating or pressure plate is the ram of the cylinder. As the plate stack wears, the ram travel increases automatically.

This design feature provides an important correlative advantage. The torque capacity of the clutch for any given oil pressure is always a constant. Each clutch engagement, creating plate wear, causes the torque value to decrease. Normally, this decrease is a small value per engagement, but in the case of high energy pickups, the decrease can be relatively great. In any event, if the clutch is not adjusted periodically, the torque capacity will eventually drop to the load value. If the resultant slippage is not detected, or if an experienced operator does not recognize what is happening, the clutch will soon "burn up."

A second correlative advantage contributed by the no-adjustment feature of the oil-actuated clutch is that with constant torque capacity assured, it is often possible to use a smaller clutch. The oil-actuated design permits the torque capacity to be directly proportional to the applied oil pressure, since this pressure creates the clamping force.

Information may be obtained by writing Twin Disc Clutch Co., Racine, Wis.

T-6-1151

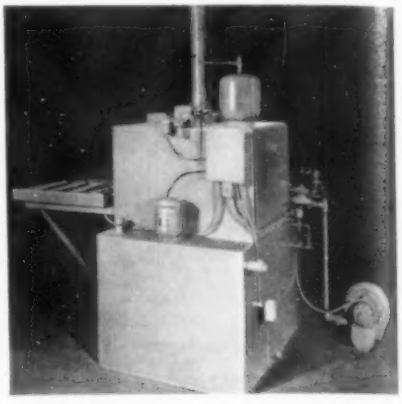
USE READER SERVICE CARD ON PAGE 139 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Automatic Washers

A line of compact, forced-circulation washers in three different sizes, designed to speed metal cleaning through automatic cycling and by combining washing and rinsing in a single operation, is announced by Ipsen Industries Inc., Rockford, Illinois. The single-stage units eliminate secondary washing and extra work handling operations by employing an automatic surface spray skim-off. When used with recommended detergent and surfactant compounds, metallurgically clean results are accomplished over 50 percent faster than with ordinary washing methods. For average load conditions, a total cycle of five to seven minutes is sufficient to thoroughly clean workpieces.

Solution temperatures, work handling, and cycles for solution circulation and skim-off are all controlled automatically by pre-settings on a panel conveniently located on the front of the washer. Because of work handling efficiency and washing speed, the units are especially adapted to line operation as well as a wide variety of standard degreasing and oil removal applications.

The compact, welded steel units are available in load capacities of 300, 4[illegible]0, and 700 lbs. Load platforms are swi[illegible]-type roller units, and can be attach[illegible] to either end of the washer for in-a[illegible]-out operation, or to both ends [illegible]r straight-through operation. Platfor[illegible] have solid pans to catch drippings.



Solution heating is provided by immersion-type elements, available for gas, electric, or steam heating. Proper, uniform temperatures are controlled by an aquastat. Temperatures can be varied to fit requirements of load and condition of workpieces for greatest washing efficiency.

Circulation and solution skim-off cycles are also controlled automatically by timer settings on the control panel, and are varied to fit individual load requirements. Setting the circulation timer initiates the complete cycle.

The load rack is held, immersed, and raised automatically by an airdraulic cylinder. As the load lowers into the solution tank, a motor-driven propeller automatically begins rapid circulation of the heated solution past curving baffles and downward through the work. The downward circulation prevents any displacement of small parts in the work basket.

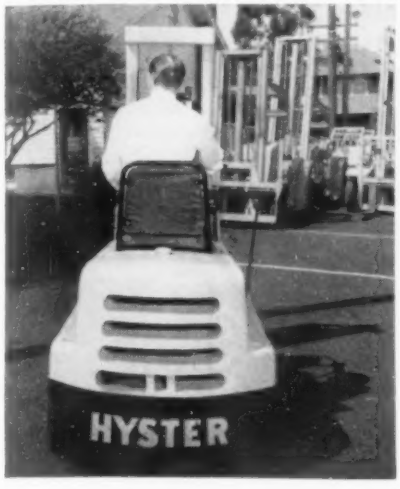
When the pre-set power-washing cycle ends, a surface spray skim-off is started on the surface of the solution and moves oil and other impurities into an overflow ledge. The overflow drain is closed during the washing cycle, but opens automatically as the skim-off cycle starts. The oil-free surface assures clean work as the rack is raised, without the necessity of a separate rinsing operation. The skim-off spray accomplishes the surface cleaning within one to two minutes. For further information, write to the manufacturer. **T-6-1161**

USE READER SERVICE CARD ON PAGE 135 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Lift Trucks

Two fork lift trucks in capacities of 3,000 and 4,000 pounds have just been released, according to an announcement of the Hyster Co., 2902 N. E. Clackamas St., Portland 8, Oregon.

They are the models YC-40 and UC-30, powered by heavy-duty, water-cooled industrial engines and mounted on cushion-type tires. Outstanding features are said to be their extreme compactness, durability and maneuverability.



The YC-40 has a capacity of 4,000 pounds at 24-inch load centers. Its narrow width of only 38 inches and short over-all length of 78½ inches permit it to operate with speed and efficiency inside boxcars and in crowded quarters. Its low collapsed height of only 82½ inches permits it to pass through ordinary doors and under low ceilings. The load can be raised 30 inches before the minimum height is affected. Ample underclearance allows safe travel over rough surfaces and inclines. The YC-40 will climb a 20% grade loaded or empty.

The UC-30 is basically the same truck as the YC-40, but with 600 pounds less counterweight and a capacity of 3,000 pounds at 24-inch load centers. The overall length is only 74⅜ inches and it will climb a 24% grade, loaded or empty.

Both trucks have a sharp turning radius of 75 inches and 30 inches of free lift on the standard 9-foot uprights. Other features include heavy duty brakes, simplified automotive-type controls, quick-change clutches and readily accessible service points.

T-6-1171

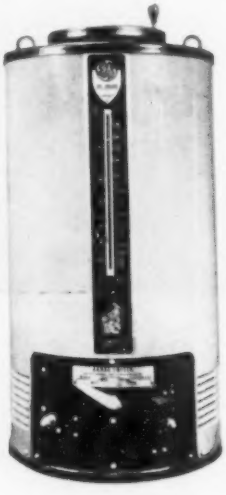
USE READER SERVICE CARD ON PAGE 135 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

A-C Welding Transformer

A 400-ampere, single-phase, a-c welding transformer with a 60 percent duty cycle has been announced by the General Electric Co.'s welding department.

Designated as G-E type WK40K, the welder provides a current range of 40 to 500 amperes, and can be used with a variety of electrode sizes for repair, maintenance and construction work.

According to the company, the transformer not only assures quick starting, but also incorporates arc-stabilizing capacitors which make it easier for operators to strike and maintain an arc without popouts. This results in faster travel speeds, fewer patch-ups, and stronger welds.



The extra-wide current range allows the use of this one machine for a wide variety of applications, from light-duty, low-current sheet metal jobs to heavier-duty, high-current industrial work. A range switch enables the operator to change quickly from high to low current or vice versa.

Other advantages of the new welder are longer coil life, because of silicone insulation, stepless current control permitting accurate adjustment, and built-in idlematic control for protection against electric shock. **T-6-1181**

Buffing Lathe

Hammond Machinery Builders, Inc., Kalamazoo, Mich., announce a 10 hp model 10 VROW wide-swing variable speed polishing and buffing lathe.

The lathe has an extended spindle affording maximum working area around the wheels and has a variable spindle speed range of 1500 to 3000 rpm. The speed is instantly changed by dial control while machine is running. **T-6-1182**

Collimator

An angle setting and checking collimator has been introduced which sets or checks angles to 30 seconds of arc or, by transferring from a sine bar, to from 5 to 15 seconds of arc depending on the sine bar and the care exercised by the operator. Like the more elaborate collimator, the device can be used for a very wide variety of applications, such as the measurement of any external angle, tapers, internal tapers, cones, hidden surfaces such as valve seats, parallelism and right angles. On the other hand, it can be used for checking the straightness of surface plates, machine beds, straight edges, etc., to fractions of a tenth-per-inch length. Then again, it can be used to set or check the cutting angle of lathe tools, milling machines, etc., on the machine because of its self-setting feature. Special problems can be handled by accessories such as the straightness deviation mirror unit, optical square, or by specially engraved dials and verniers.

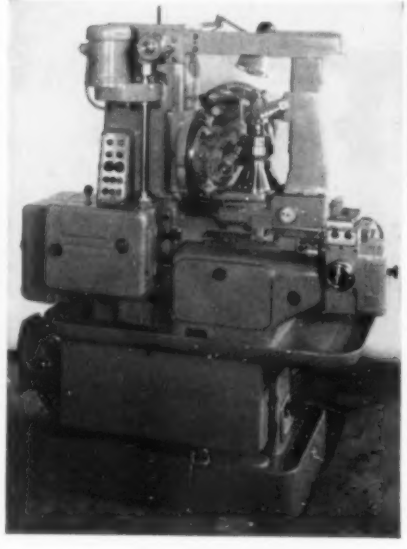
A feature of this model 8 collimator is the way cost has been cut without sacrifice of essential accuracy for even highly precise machine shop work, or without loss of rigidity or optical alignment of any part. This has been made feasible by the skillful use of special black plastic materials for all possible parts, and by the use of a dial and vernier machine engraved by semiproduction techniques which are within the accuracy requirements of the new instrument. Then again, instead of having the collimator revolve in hand-lapped double cone bearings on the dial unit, the collimator and dial assembly revolves in a ball-bearing arrangement on the main mount unit. Made by Mitchell Scientific, 39 MacQuesten Parkway North, Mount Vernon, N.Y.

T-6-1191

USE READER SERVICE CARD ON PAGE 135 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Gear Hobbers

A line of Precision Gear Hobbers for spur, worm, and helical gears and spline shafts is distributed by Transmares Corp., 15 William St., New York 5, as factory representative for Pfauter, Ludwigsburg, West Germany. Gear



Hobbers up to 60 inches diameter and pitches up to 1½ dp are available. Special index drive is standard and permits readjustment for backlash without altering center distance. Additional features are hydraulic climb hobbing arrangement, automatic feed, automatic work cycle control, and tangential cross feed. **T-6-1201**

Universal Handle

A universal handle for reversible go and no go plain and thread plug gages in cabinet sets has been developed by Size Control Co., 2500 W. Washington Blvd., Chicago 12, Ill. Each gage mem-

ber is supplied with an aluminum bushing, which permits the user to make up multiple combinations of go and no go sizes in the universal handle. Eight handles in a set will accommodate a range of plugs from 0.010 to 0.750-inch diameter. The handle is made of anodized aluminum. Plug members can be adjusted to required length to minimize breakage. **T-6-1202**

USE READER SERVICE CARD ON PAGE 135 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Milling Machine

A Hero milling machine, plain or universal, with a table size 39½ x 9¼ inches and six longitudinal power feeds, is introduced in this country by Morey Machinery Co., Inc.

It features anti-friction bearings, well constructed knee, 12 spindle speeds, 6 table feeds and 2½ hp motor.

Further information on the machine may be had by writing Morey Machinery Co., Inc., 410 Broome Street, N. Y. 13. **T-6-1211**

Air Hoist

An air hoist, weighing 27½ lb with capacity to lift 1000-lb loads at 40 ft per minute, is announced by the Aro Equipment Corp., Bryan, Ohio. The hoist is a roller chain type, powered by rotary vane air motor.

Because of numerous operating advantages, the hoist is suited for a wide range of applications such as loading and unloading on shipping docks, in heat-treating plants and departments, in refineries, chemical plants and plating departments, in machine shops and foundries, in automobile, appliance, furniture, textile and aircraft assembly lines, and handling bar stock in stockrooms.

Operating at its rated capacity of lifting 1000 lb at 40 ft per minute, the hoist does the job nearly 2½ times faster than other comparable air or electric hoists, according to the manufacturer. This feature is especially important in heat-treating departments as well as many other applications where speed in materials handling helps to increase production and lower costs.

The operator can regulate the rate of lift by throttle control which is infinitely variable from 0 to 40 ft per minute. This permits inching the load where required. Also, the hoist is designed so that it will not slip down before going up. Due to the vane type motor, the load can be lowered with safety and complete control at speeds exceeding 100 ft per minute.

The hoist meets requirements for explosion-proof operation. It also has safety snap hooks, top and bottom, adjustable safety stops on chain to limit the lift and descent, and a safety brake which automatically locks when control is released. This assures that the load will remain suspended if the hose is accidentally disconnected or the air shut off, yet the load can be released by throttle control and safely lowered.

All parts, chains, hooks, connections, pins, swivels, supports and housing are designed with a safety factor in excess of the rated capacity of the hoist. This includes shock loads (quick jerking starts and stops). **T-6-1212**

Office Duplicator

An office machine for the rapid production of multiple copies of letter-size papers, has been announced by the Eastman Kodak Co.

This unit, known as the Verifax printer, can make three or even more copies, costing less than 5 cents apiece, from a single matrix sheet. These copies are same-size, black-on-white duplicates of the original material and are immediately ready for use.

With the printer, one photo-exact copy can be obtained in about 50 seconds, and three copies in 60 seconds. Copies are long-lasting, have good legibility, and can be referred to, written on, mailed, or filed as desired.

Copies can be produced in any office under ordinary illumination. The only service connection is a 110-volt outlet.

Copies can be made from practically any typed, written, drawn, or printed original through the 8½ x 11 inch size, including books and magazines and other pages printed on both sides. They may be produced by anyone with only a few minutes instruction on how to operate the Verifax unit.

The Verifax Printer utilizes the reflex printing method. The sensitized matrix is first placed on top of the lamp bank built into the top of the printer. The letter or document to be copied rests face down, on top of the matrix. Exposure is controlled by an electric timer built into the unit.

After exposure, the matrix is slipped into an activator solution in the bottom of the unit. This simple single solution is easily mixed and in general office operations, lasts a week. The matrix paper is left in the activator for twenty seconds. As the matrix is withdrawn, it is pulled under a roller in contact with a sheet of Verifax print paper. This paper is not sensitized. After the two sheets are withdrawn from the printer, they are stripped apart, and a copy of the original document is ready to use.

Extra copies of the document may be made as rapidly as the matrix can be re-inserted in the activator and withdrawn in contact with another sheet of Verifax print paper.

Copies from the matrix can often be made on regular paper or blank office forms instead of Verifax print paper. A number of commercial office papers have been tested in this connection and found quite satisfactory.

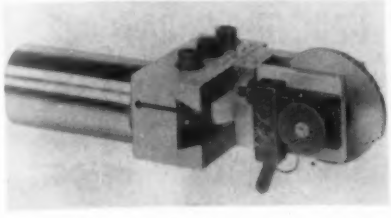
Whenever more copies are needed than come from one matrix, extra copies may readily be produced by repeating the procedure with a new matrix sheet.

For information as to availability, contact the Industrial Sales Division, Eastman Kodak Company, 343 State Street, Rochester 4, New York.

T-6-1221

Roll Marker

A marking device for screw machines, which permits die marking of part numbers, patent numbers, trade marks, etc., on the end face of parts during the machine cycle, has been added to its line of automatic roll markers by New Method Steel Stamps, Inc., 147 Jos. Campau, Detroit 7. Suitable for both light and heavy work on automatic and hand operated screw machines, bench and turret lathes, etc., the new marker, model 600-E is useful for marking end face of parts on any diameter of face of 1½ inch and up.



According to the manufacturer, the marker eliminates the need for separate setups for marking, reducing cost, scrap, etc. Easy disassembly of the marker for rapid interchange of lettering rolls is possible by removing two conveniently placed Allenhead cap screws, the entire control mechanism and roll die shaft coming off as a single package unit. This usually can be done without resetting the holder in the machine.

Other features of the automatic marker include heavy dove-tailed ways in the holder head to permit transverse adjustment of roll die holder for selection of marking diameter on the end face of parts. Accurate, machined scale on marker head for quick setting of desired marking diameter, three readily accessible Allen-head screws insure positive clamping pressure. The heavy duty shank is available in standard 2 inch diameter, maintains marker alignment and insures uniform marking impression. Ratchet lock holds the die in cleared position, eliminating scoring or dragging on parts at end of marking. Marks once only on each part, elimination chance of double impression. Roll die is automatically reset for next part by tripping of ratchet pawl during the last ⅛ in. of return stroke of the slide. Marker uses either solid dies or interchangeable type in roll holders if desired. The standard New Method roll dies have keyways located with reference to the starting letter so that no readjustment of the marker is required when changing dies. Special drawings for die blanks are not required. Simple design for minimum maintenance and ease of setup. Anti-friction ball bearing shaft mounts are quickly replaceable and available from any jobber. Replacement parts are standard and immediately available from manufacturer's stock.

Depth of marking impression is controlled by means of a starting cam on the roll die. Contact point of the cam with the part is shifted to a higher or lower point on the lobe (for lighter or heavier characters) by loosening a lock nut and turning the adjusting screw at the top of the unit. After proper depth of lettering has been selected for the material being marked, the lock nut is tightened and no further adjustment is needed until the type of part in production is changed.

The cam or starting pad extends some distance ahead of the first character, providing variation of marking depth and uniform depth of impression since any machine slack is taken up before actual marking begins. It also eliminates the need for special cams or feeds on the screw machine. **T-6-1231**

Torque Tester

The P. A. Sturtevant Co., Addison, Ill., announces a torque testing fixture. They are universal, simple and unique in design. A fully adjustable spindle set in instrument bearings is held in rigid alignment and permits rapid engagement of the driver with the work. The spindle has a female drive square to accommodate a wide selection of torque wrenches within the capacity of each of the two models. The driving end of the spindle is threaded so that users may design drivers for special applications. A standard male drive square attachment is included with each fixture and is fitted to the driving end of the spindle. This permits using regular sockets, socket screw drivers, etc. without alteration. A T-slot base makes it convenient to clamp nests and holder to the fixture. **T-6-1232**

Low Speed Motors

A line of Circle B synchronous motors, designed for applications where extremely low speed at light loads is required, is announced by the Bristol Motor Division of the Vocaline Co. of America, 211 Coulter Street, Old Saybrook, Conn.

Known as the S-200 series, the motors are available at speeds from 10 revolutions per hour to one revolution per month.

This motor features an additional exposed low speed gear train and will handle a continuous load up to one inch lb. Torque is limited by gear train to 1 inch lb continuous, 5 inch lb intermittent use. **T-6-1241**

Pyrometer Controller

A new line of Free-Vane electronic pyrometer controllers has just been announced by The Bristol Co., Waterbury 20, Conn. The controllers actuate relays, electric contactors, solenoid valves and motor valves to provide close temperature control of a wide variety of furnaces, ovens, kilns, salt pots, plastic molding machines, and other heating equipment.

The Free-Vane controllers feature a unique electronic control system based on the frequency modulation principle, a newly-developed millivoltmeter mechanism, and unit plug-in construction. The basic model can be used for low-open, high-open, and low-high control. A model with an additional plugin unit

makes possible proportional current input to provide practically straight-line control of many heating appliances. A double control unit model is offered to provide low-open-high or low-normal-high control. All models are available with themocouple failsafe protection to protect the heating appliance in case of thermocouple burn-out or other failure. The controllers are made in a wide selection of temperature ranges from 0-400 F to 0-3000 F.

A bulletin No. P1248 is available. **T-6-1242**

Overload Clutch

The Overload Release Clutch Co., Inc., 1162 Stuyvesant Ave., Irvington, N. J., has developed an overload release clutch which can be installed on sprocket, chain, belt and gear drives. This safety device has instantaneous trigger action and is designed to allow machines to resume operation at the exact cycle point of release.

It was stated that this new clutch will work consistently within very close limits. In addition, the clutch is permanently lubricated with continuing protection assured for machinery because there are no parts that can wear out.

This overload release clutch can be used over a wide range of speeds and shaft sizes. **T-6-1251**

Lift Truck

Market Forge Co., Everett 49, Massachusetts, announce their 1953 lift truck. The same interchangeable mechanical and hydraulic features are applied in this load lift as in previous models. The hydraulic system is non leaking even when truck is on its side.

The front axle support assembly and fifth wheel is now made of certified malleable iron instead of welded steel, and incorporates with it, as an integral part, the pivot for the handle hold up bracket. This design eliminates the swivel collar and set screw. The upper head has been reinforced. The front link shaft has been eliminated and both ends of front link furnished with hardened bushings. One of the important additions has been a new type of semi-steel multiribbed wheel as standard equipment. On the 10 inch-diameter front wheels, standard on all models, there are 30 staggered ribs, 15 on one side and 15 on the other of a solid central web. This multi ribbing reinforces the wide treads against breakage even when one edge passes over a hard obstruction on the floor such as a bolt or rivet. Rear wheels are ribbed in the same manner with number of ribs depending on diameter, but circumference spacing approximately the same. The staggered ribs also allow the molten metal to flow better, thus resulting in finer castings.

Fabricated unbreakable rolled steel wheels are optional as well as neoprene or regular easy rolling cushion rubber and phenolic resin plastic. All wheels are always equipped with large bore sealed ball bearings which makes these trucks easy to haul with heavy loads. On a level steel surface plate, less than a five-pound pull with start and pull 5000 lb. Optional equipment also includes heavy duty double ball bearing fifth wheel for the roughest kind of service.

Other optional equipment includes special widths, extra high lifts, up to 10,000 lb capacity, swivel casters, wheels filled with oil for constant bearing lubrication under severe conditions, auxiliary hinged lifting frames to enable various heights of skids to be handled with same truck, galvanized frame, corrosion-resisting hydraulic mechanism. The truck is also available for handling single faced or double faced pallets and equipped with open end frame design for handling special containers, skids and pallets. **T-6-1252**

Stabilized Crane

A Tramrail stabilized crane which eliminates the usual swinging of a load being hoisted or transported from one area to another has been announced by Cleveland Tramrail Division of The Cleveland Crane & Engineering Co., Wickliffe, Ohio.

Elimination of load swing is helpful in speeding tank-dipping operations such as anodizing, chromodizing and similar plating operations. It is an aid in various assembly operations since parts or assemblies being worked on can be held solidly in position. The no-swing feature is also advantageous for supporting traveling X-ray equipment used for making studies of long objects. It makes possible the delivery of hot metal in a foundry by an automatic dispatch method direct from cupola to molding area.

The crane has a simple arrangement of hoisting ropes which form a triangular suspension. This permits a load to be held rigidly in place so as to eliminate longitudinal, lateral and rotational sway. Thus, a load can be raised or lowered through a considerable distance and yet with nothing more than the hoisting ropes supporting it, will remain rigid. **T-6-1261**

Piston Gage

A piston gage manufactured by The Sheffield Corp., Dayton 1, Ohio, provides simultaneous gaging of piston skirt diameter at two places, of taper from top to bottom, and of the cam grind on the skirt at three points. In measuring the diameter, the Precisionaire also indicates in which one of eight classifications the piston belongs.

The gage consists of a chrome-plated ring containing a number of air jets and two Sheffield Plunjets connected to a five-column Precisionaire.

Gaging is simple and fast. The operator inserts the piston into the gage with the head up. Instantly the position of the floats in the glass columns indicate whether or not the piston is dimensionally correct. Cam grind is checked at points 20 degrees and 90 degrees on each side of the major axis at the bottom of the skirt. Taper is measured between the upper and lower skirt diameters by comparison of two float positions. **T-6-1262**

Band Saw

A horizontal band saw, announced by Wells Mfg. Corp., is the first metal cutting band saw designed to capitalize on the advantages of the Milford Rezistor high speed steel band saw blade. Designated by Wells as model 800, this new machine is the first metal cutting band saw to be approved by the producers of the Milford Rezistor blade.

Design features which distinguish the model 800, include: heavy duty counterbalance frame and beam; new style band wheels providing for use of 1 inch wide blades; new constant-load blade tensioning device; and synchronized speed blade cleaning brush.

While the model 800 was developed especially for use with the new high speed steel blade, it also can be used effectively with standard carbon steel blades. When used with the new blade though, the model 800 is claimed to have established new records for greater cutting efficiency and cuts per blade, particularly in cutting stainless steel. Capacity of the new machine is 8 inches in diameter.

Further information can be obtained from Wells Mfg. Corp., 600 Service Road, Three Rivers, Mich. **T-6-1271**

Wheel Dresser

A Radix wheel dresser for quick and accurate tangent or radius dressings on any standard model surface or internal grinder with up to 8-inch wheel has been announced by the Cleveland Radix Tool Co., 1025 Broadway, Cleveland. The compact dresser holds diamonds from 3/16 to ½ inch diameter and maintains a 0.0001 inch radius tolerance. It features rugged construction of hardened, ground and lapped tool steel. For quick and easy setting of diamonds to any desired radius, the wheel dresser comes complete with a master gage. The diamond holder can be stopped at any radius point, with positive stops also provided for 90 and 180 degrees. The base measures 4 x 5 inches; height 5½ inches capacity: 1⅛ inches male or 2 inches female radius. Larger model is also available for wheels up to 16 inches. **T-6-1272**

Coolant Pump

A self-contained, motor-driven coolant pump that is quickly and easily adaptable to a wide range of work is announced by Viking Industries of Rockford, Ill. The model is individually powered by a 1/30 hp oil-sealed motor and is designed to operate efficiently with all types of water soluble coolants and oils up to 20 SAE viscosity.

Suitable for interchangeable applications, the Viking has a rated capacity of 100 gph at a 1-ft head. The motor is a shaded pole type, operating on standard 110 v., 60-cycle ac at 1500 rpm. The centrifugal pump is mounted directly on the extended drive shaft of the motor. The inlet pipe has a ½ inch opening and is equipped with an automatic foot valve to hold prime. Flexible spout outlet is ¼ inch.

The complete unit weighs three pounds, measures 4½ inches in diameter by 15 inches high. The housing is made from heavy duty brass, and the spout is flexible spring steel tubing connected to a copper shut-off cock. **T-6-1281**

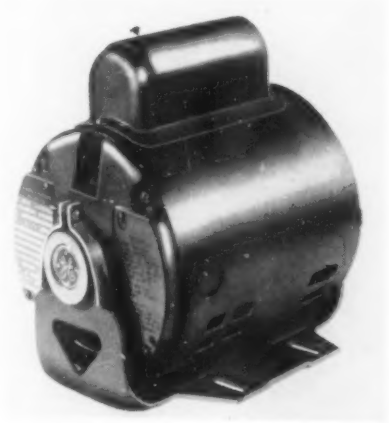
Foot Valve

This cast aluminum base has been designed to enable the operator to use the valve with the foot in a comfortable position. A light touch of the foot on the pedal operates this valve. It need not be fastened to the floor and can be moved to suit the operator's convenience.

Ports are ¼ inch. The valve operates on air lines up to 100 psi and has adjustable speed control in either direction to give fast or slow operation of cylinder ram. Made by Air Fixtures, Inc., Dept. 90, North Manchester, Ind. **T-6-1282**

Small Motors

Two special-service, fractional-horsepower motors, for applications requiring moderately high starting torque, have been announced by the General Electric Co.'s fractional horsepower motor department.



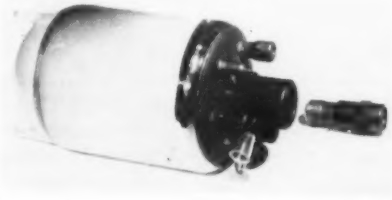
Rated at ½ and ¾ hp, 1725 rpm, the motors can be mounted in any position, and can easily be reconnected at the terminal board for 115 or 230 volts. They are smaller and lighter in weight than the corresponding general-purpose ratings, according to the company.

T-6-1291

X-Ray Amplifier

An X-ray image amplifier that produces images 800 to 1200 times brighter than those obtained with the conventional fluoroscope has been announced by the North American Philips Co., Inc., 750 South Fulton Ave., Mount Vernon, N.Y.

Soon to be made available to the U.S. market, the device is a development of the Philips Laboratories, Eindhoven, Holland, and will improve existing fluoroscopy techniques.



The device consists of an evacuated glass tube presently about 18 inches long and 7 inches in diameter with one flat end and the other hemispherical, curving outward. Inside the hemispherical end is a curved fluoroscopic screen in direct contact with a photocathode. On the inside at the flat end is a second fluorescent screen, reduced 9 times in size. External to the glass tube, but mechanically coupled to it, is a simple optical microscope with a magnification power of approximately 9.

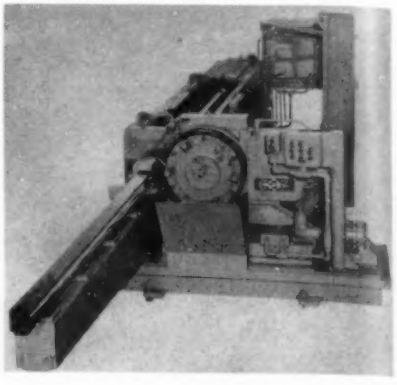
In use, the X-ray image amplifier is used in place of the conventional fluoroscope screen and X-rays pass through the hemispherical end of the glass tube to the internal screen which then fluoresces. The fluorescent light sets electrons free from the photocathode and the number of photoelectrons released per second is proportional to the intensity of the fluoroscopic screen at that point. The luminous image with all its variations in brightness is thus transformed into an electronic image with corresponding variations in current density. By means of an electric field of a certain configuration (electrostatic electronic lens) this electronic image is reproduced on the viewing screen, reduced 9 times in size. The energy of the electrons falling on this screen is in part converted to fluorescent light, and a reproduction of the image is seen on the viewing screen reduced 9 times. This reduced image is viewed through a simple microscope of about 9 magnification, and finally the image is seen erect and in its original size, since both the electronic lens and the microscope produce inverted images.

The complete equipment for use of the X-ray image amplifier includes a lead-lined aluminum jacket for the tube which can be conveniently mounted on a stand, and a small high-voltage supply unit for 25 kv d-c which is connected between the cathode and anode.

T-6-1292

Broaching Machine

Colonial horizontal broaching machines for automatic broaching of external scallops or slots on different types of jet engine rings, have been developed by Colonial Broach Co., P.O. Box 37, Harper Station, Detroit 13.



The machines are basically standard 10-ton, 60-inch and 10-ton, 90-inch stroke horizontal broaching machines. The 10-ton, 60-inch machine broaches three scallops with each pass of the ram. The 10-ton, 90-inch broaches a single dovetail slot with each stroke. Fully automatic, the work shuttles into the cut and the ram starts. At the completion of the stroke, the fixture recedes away from the broach cut, and the ram returns to starting position.

The part is then automatically indexed one increment, and the process is automatically repeated until all slots or scallops are completed. Then the fixture automatically recedes to loading position. Pneumatic or mechanical ejection for the finished part is optional on the machines.

Hydraulically actuated shuttle movement, which slides on the base using box type square gibs, is mounted low to allow mounting of large diameter workpiece. Positive mechanical locking is provided to secure work in broaching position.

Indexing, hydraulically driven, is through change gears and a Geneva movement, controlled by limit switches, and with positive plunger locking. Selective electrical circuits are provided for fully automatic operation, single indexing, or independent inching motions, including both forward and reverse.

Machines are so constructed that they may be shipped in three separate subassemblies, and assembled in the production shop. Force feed lubricates machines at each pass of the ram.

T-6-1301

USE READER SERVICE CARD ON PAGE 135 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Sub Press

Price Machine Products, 929 West 80th St., Los Angeles 44, has announced a new series of Paragon self-aligning sub presses for use with kick, arbor, air, or punch presses.

These presses are said to increase the production capacity of every type of press by eliminating the need for complicated and time-consuming set-ups for staking, piercing, bending, forming, and assembling operations.

Each operation can be tooled in a matter of seconds and the setup left permanently in the sub press. When a change in operation is desired, the sub press containing the required setup is put in place on the power or hand press bolster and the production run is immediately resumed.

Perfect alignment, regardless of the inaccuracies in moving parts of the arbor, kick, air or punch press is assured because the ram and lower tool holes of the sub press are line bored to precise tolerances. **T-6-1311**

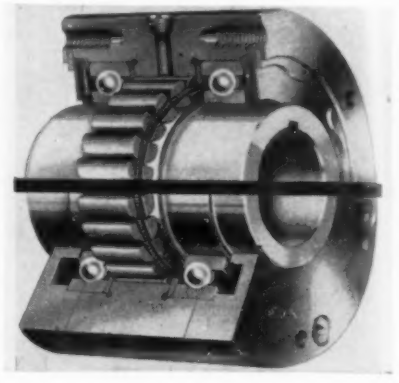
Carbon Rods

A high-purity spectrographite rod for critical chemical and metallurgical analysis by the spectrographic process has been announced by the Stackpole Carbon Co., St. Mary's, Pa. Whereas normal graphite electrodes contain impurities on the order of 0.02 to 0.05 percent, the Stackpole grade PG4 rod has less than 0.001 percent. It is supplied in lengths up to 12 inches and in diameters of 1/8, 3/16, 1/4 and 5/16 inch.

A copy of Catalog 40A, may be obtained on letterhead request to the manufacturer. **T-6-1312**

Sprag Assembly

A development by the Formsprag Co., Van Dyke, Mich., makes it possible for overrunning clutches to operate at speeds exceeding 3000 rpm, according to technical data just released by the manufacturer.



A centrifugal throwout sprag assembly eliminates any possible rubbing between the sprags and the inner race. This new feature is available in the Formsprag all-purpose ball-bearing clutch, a standard model with eight possible variations.

Construction of Formsprag clutches consists of only four basic parts: outer housing, inner race, full complement of sprags, and energizing springs. The sprag principle, with its full complement feature, provides an infinite number of gripping positions and eliminates backlash. Maximum torque capacity for size and weight and long life because of changing contact points are other advantages claimed for the sprag type of clutch construction. **T-6-1321**

Speed Control Valve

A speed control valve has been announced by Ross Operating Valve Co., 120 East Golden Gate, Detroit 3. The valve, which can be used wherever it is necessary to control the flow of air, provides split-second timing of piston movement by positive control of air flow. It can be mounted in any position between the operating valve and one or both ends of a cylinder to provide airflow adjustment.

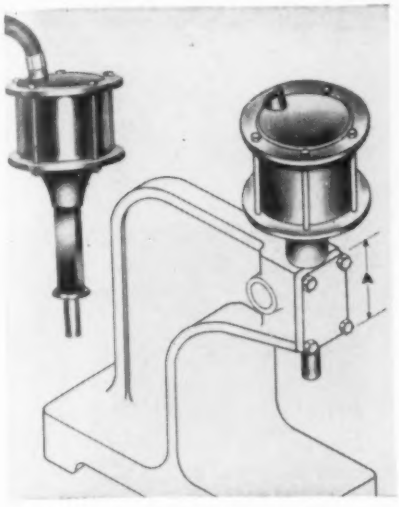
A feature of the valve is the ease of adjustment, accomplished by the many turns provided on the adjusting stem. The orifice controlling this flow can be quickly adjusted from practically zero to wide open.

Construction of this valve is simple and rugged. The poppet is the only moving part. The valve is designed for extreme ease of maintenance and can be disassembled without breaking the line connection. It is available with ¼, ⅜, ½, ¾, 1, and 1¼ inch ipt.

T-6-1322

Press Attachment

Any hand-operated arbor press can become an air press by simply removing its present ram and replacing it with a Paragon air-conversion unit designed specifically for that make and model hand press.



The ease of interchangeability permits the user all the advantages and flexibility of having both an air press and a hand press. All tools and fixtures which were made to fit on the bed of the hand press can be used with the air unit without any changes necessary.

The units, complete and ready to use, can be had with cylinders having a power factor of either 12.5 or 19.6 times that of the air-line pressure.

Information regarding the Paragon air-conversion unit can be obtained by writing Price Machine Products, 929 W. 80th St., Los Angeles 44.

Stainless Valve

For use with acids and other corrosives, a nonleaking stainless steel check valve has been perfected by James-Pond-Clark, 2181 East Foothill Blvd., Pasadena, Calif. The valve incorporates the firm's Circle-Seal principle but employs Teflon O rings and gaskets for this special usage due to the chemically inert properties of this material.

It is pointed out that a characteristic of Teflon is that it flows under pressure which becomes an advantage when employed with the Circle-Seal principle in that it actually increases the sealing efficiency. These stainless steel valves are supplied in various grades depending on the required service with male tube or female pipe connections.

Recent tests conducted by the company have indicated they provide perfect performance and dead-tight sealing from temperatures below –65 F to 550 F.

T-6-1332

Tote Pans

The Morrison all-steel Stak-box is designed to provide a safe, as well as a time, labor and space-saving method for transporting and storing parts and material. Job operations can be expedited by moving inventoried quantities of parts in Stak-boxes, with a crane, fork lift, boom truck, or dollies.

Stak-boxes are constructed of heavy, formed steel frames with sides and bottom of sheets of 9-gage, unflattened, expanded steel. This gives maximum strength and load capacity with a relatively lightweight unit. These boxes are 50 inches square at the top, 49 inches square at the bottom, with a 24-inch over-all height. This tapered frame feature insures solid, positively safe stacking. Each box will accommodate up to 7000 lb. Four equally spaced ¼ x 2-inch steel reinforcement bands are welded across the bottom for maximum strength and over-all rigidity. Heavy hook plates at the four corners provide a safe, convenient method for quickly lifting Stak-boxes with a crane.

Made by Morrison Steel Products, Inc., 601 Amherst St., Buffalo 7, N.Y.

T-6-1341

Cutter Grinder Dog

A cutter grinder dog that can be readily adjusted to different diameters of work is the development of Ready Tool Co., 554 Iranistan Ave., Bridgeport 5, Conn. Its versatility permits use in work that formerly required as many as four dogs.

The cutter grinder is particularly suited for small work, for its construction permits getting close to the face plate. Two sizes are made: No. 100 has a capacity from ⅛ to 1½ inches, and No. 99 accommodates work from ½ to 2½ inches. **T-6-1342**

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THE TOOL ENGINEER'S *Service Bureau*

TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

LITERATURE NUMBER	COMPANY	BULLETIN	DESCRIPTION
A-6-248	Allegheny Ludlum Steel Corp.		New booklet offers full information on complete line of FCC Smooth Hammered Forgings—rings, hubs, discs, sleeves, etc.
A-6-174-1	Alpha Tool Works		All details given on new 100-ton Die Tryout Press in free folder.
A-6-216	American Broach & Machine Co.	300	American SB-42-10 and other American machines described fully in circular.
A-6-133	B. C. Ames Co.	38	Ames' "Hundred Series" indicators available in four sizes. Free catalog stresses accuracy and sensitivity.
A-6-231	Bay State Abrasive Products Co.		Cutting action, grinding applications and other methods described in new cylindrical grinding wheel brochure.
A-6-167	Behr-Manning Corp.		"Blueprints for Faster, Better Production" contains typical cases of coated abrasives, correctly applied.
A-6-16	The Bellows Co.		Cut your drill press costs to a new low with 16 pages of facts in new booklet.
A-6-188	Besly-Welles Corp.		"Handbook for Tap Users" covers hints on tapping methods and tap selection.
A-6-30	The Bristol Co.		Better design, faster production, easier maintenance assured with company's hex socket cap screws. Free catalog.
A-6-149	Brush Electronics Co.		Bulletin gives information on how recording analyzers are a boon to product development.
A-6-235	Bryant Machinery & Engineering Co.	183	Advantages of vertical grinders stressed in catalog.
A-6-195	The Bullard Co.		"Bullard Vertical Chucking Grinder Catalog" available describing 6 sizes of grinders.
A-6-200	Cadillac Stamp Co.	M-120 SE-130	Marking devices designed for all marking needs—for perfect product indentification.
A-6-35	The Carborundum Co.	3	"MX Products" tell-all booklet stresses versatility in grinding.
A-6-33	The Cincinnati Shaper Co.	S-6	Speed and versatility of company's shears described in Shear Catalog.
A-6-151	The Cleveland Tapping Machine Co.	TL-64	Production problems made easier—production costs cut with company's tapping machines.
A-6-220-1	Comtor Co.	46	"Packaged Precision" with Comtorping. No wires, hose, electronic gear or heavy base.
A-6-261	The Cushman Chuck Co.	64TE PO-64TE	Catalogs offer information on how to conserve your manpower.
A-6-207	Danly Machine Specialties, Inc.		Accuracy, flexibility, high capacity—important features of company's hydraulic metalworking equipment.
A-6-157	Erickson Tool Co.	J	Precision expanding mandrels and their advantages listed in catalog.
A-6-273	Ex-Cell-O Corp.	35371	Bushing Catalog lists qualities of company's bushings and tools.
A-6-152	A. B. Farquhar Division, The Oliver Corp.		Free catalog tells how Farquhar presses cut costs and assure faster production.
A-6-192-1	M. A. Ford Mfg. Co., Inc.	207	Complete details, operating data and specifications on more than 300 Ford rotary tools contained in new catalog.
A-6-218-1	Galland-Henning Mfg. Co.	SW-1	Bulletin stresses versatility and production increase with Nopak valves and cylinders.
A-6-17	Gisholt Machine Co.		"Wear and Surface Finish" textbook tells complete story of superfinish.
A-6-19	Gisholt Machine Co.		Simplimatic provides fully automatic operation. New catalog shows many examples.
A-6-20	Gisholt Machine Co.		Up-to-the-minute facts on balancing given in booklet "Static and Dynamic Balancing."
A-6-124-2	Graymills Corp.		New catalog with easy-to-use pump selection chart answers many machine tool needs.
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Disc Sander

A major feature of the Apex 20-inch disc sander and grinder is the reversing switch with motor overload projection. Reversing action permits efficient surfacing of right and left hand jobs, and, it is claimed, extends disc life 20 to 30 percent.

A handwheel tilts the table to any angle from 45 percent up, to 45 percent down, and a protractor assures extreme acuracy. Another handwheel moves the table down 11 inches, exposing the entire disc. For grinding angles, there is a meter gage which is easily set at angles to 90 degrees both ways. The hazardous table slot is filled by a safety bar. And when work being ground strikes the disc guard, the guard tilts back, allowing full use of the 20-inch disc surface.

The manufacturer states that the Apex will remove and shape metals, plastics and wood to close tolerances, and at low cost. Models are available in 20 and 16-inch disc sizes. Write Rankin Bros., Precision Machine and Tool Works, 11090 S. Alameda Street, Lynwood, Calif., for further information. **T-6-1371**

Battery Charger

The Baldor Electric Co., 4353 Duncan Ave., St. Louis 10, Missouri, announces development of a dual voltage fast charger which charges a six-volt battery at a rate of 80 amperes or less and, in addition, charges a twelve-volt battery at a rate of approximately 40 amperes. Additional features include first grade ammeter, light weight, approximately 30 pounds, and an arrangement under which the time switch automatically shuts down the fast charge to a safe soaking charge when it runs to an O position. For further information, write the manufacturer. **T-6-1372**

Reciprocating Machine

The latest developments in precision reciprocating hand machines are embodied in the new Di-Profiler.

Driven by a flexible shaft having standard connections, the new Di-Profiler has a controlled stroke, variable from 0 to 6 mm ($\frac{1}{4}$ inch), and a speed of reciprocation that can be varied from 0 to 100 strokes per second.

The Di-Profiler permits greater speed and accuracy in filing, lapping, scraping, honing and polishing on even the most delicate and intricate pieces. It is reported to be especially advantageous for honing and lapping straight and curved surfaces; for reworking hardened materials; for finishing complicated dies and molds and regular or irregular drawing dies; for precision lapping of small holes.

Simple in construction, the Di-Profiler weighs less than one pound. It is free from vibration and is easily controlled during operation. A broad range of diamond and tungsten-carbide files, points, blades, scrapers, cutters and other tools has been designed for its many uses. The machine, and accessory tools are described in a catalog available from Engis Equipment Co., 431 South Dearborn St., Chicago 5. **T-6-1381**

Lubricant

This lubricant is used for diamond wheel and lap lubrication to eliminate the loading and glazing of diamond wheels. The manufacturer emphasizes that tool finishes are produced with the maximum degree of finish so essential to the carbides, without any pressure on the diamond wheels or laps. Diamond wheels and laps show far greater production and greatly adding to life of wheels and tools. The manufacturer has recommendations in the use of Stadoil for diamond grinding, for lubricating wire drawing dies, for lens generating laps, and as a carrier for diamond dust. For further information, write to Stadoil Manufacturing Company, El Monte, California. **T-6-1382**

Cam Calculator

This calculator contains practically all information needed in laying out a set of cams. The calculator consists of two circular logarithmic scales which revolve around a central pivot pin.

This particular calculator is said to have many advantages over the common method of using a slide rule in that it gives the answer directly to the correct decimal place. This lessens the necessity of making mental calculations which lead to inaccuracies and fatigue.

The calculator is designed around the formula where:

$$S = \text{constant } \frac{Y}{Z}$$

It is important in using the calculator that the outer scale should always be used for the dividend and the inner scale for the divisor. The answer is then read directly on the outer scale opposite the arrow that has the proper formula located near the arrow on the inner scale.

Using the calculator is easy.

Required revolutions per minute can be designated N. Assume surface feet per minute C is 200 and D equals the diameter in inches. The constant is 3.82. The formula is thus:

$$N = 3.82 \frac{C}{D}$$

Using the outer scale for the dividend, 200, move the inner logarithmic scale so that 0.5 is opposite the 200. The answer, 1530 rpm, is located on the outer scale opposite the arrow and formula $N = 3.82 \frac{C}{D}$.

Assume the spindle revolutions (n) for a single cutting operation are required. The formula is $n = \frac{L}{S}$.

Length L is $1\frac{1}{4}$ inches and S, the feed in inches per revolution, is 0.004 inch.

It is then quite simple to place the dividend, 1.250, on the outer scale and the divisor, 0.004, on the inner scale. The answer, 313, is read on the outer scale opposite the formula $n = \frac{L}{S}$.

To determine the production time in seconds T or production time for threading or tapping, the formula type again conforms to the original where:

$$T = 60 \frac{\Sigma N}{N}$$

In this case $\frac{\Sigma N}{N}$ is equal to the total number of spindle revolutions required for production time, or 832 revolutions. N is to be 1850 rpm.

Reverting to the logarithmic calculator opposite the dividend, 832 on the outer scale of the calculator, place the divisor 1850 on the inner scale. The answer is easily read as 26.9 on the outer scale opposite the arrow and formula that was used.

This same formula can be used for determining the time for threading or tapping on multispindle automatics. In this case, $\frac{\Sigma N}{N}$ must be equal to the number of threads to be cut and N equals the effected revolutions per minute for threading and tapping in or threading and tapping out.

The cam calculator has many other features, such as those which permit determining cutting feet per minute, finding the total spindle revolutions required for production time, the number of hundredths required for a single operation, and for determining the gross production in pieces per hour.

The calculator is easy to operate, accurate, and economical. It is available from Screw Machine Specialties Co., Suite 703, Terminal Bldg., Rochester 14. **T-6-1391**

Grinding Fixture

This grinding fixture is said to incorporate the essential features required for relief grinding of end mills, both spiral and straight flutes, counter sinks, spot facers, center drills and reamers.

The rocking head permits drawing the cutter or reamer away from the wheel for indexing and retracting the spindle. The tools are held in the spindle by collet bushings ranging in sizes from $\frac{1}{8}$ to $\frac{3}{4}$ inch and $\frac{3}{4}$ to 1 inch. The second spindle or special collet bushing can be furnished by order for holding any type of cutter of center up to $1\frac{1}{4}$ inch diameter.

Two types of bases are furnished as desired; one is the hinged type for angular grinding. Both bases will swivel to any position radially. For information, write to: S & D Engineering Co., 525 Commercial St., Glendale 3, Calif. **T-6-1392**

Belt Filter

Automatic, continuous filtration of water soluble coolants for individual grinders, hones, and other machine tools is provided by a constant vacuum, endless belt filter developed by the Industrial Filtration Division of U. S. Hoffman Machinery Corp., 219 Lamson St., Syracuse 6, N.Y.

Called the Vacu-matic filter, the unit provides automatic, self-cleaning operation, keeps coolant cool and delivers de-watered sludge for easy disposal, according to the announcement. Because it employs vacuum rather than gravity, the Vacu-matic is described as four times faster in its filtering operation than previous endless belt filters.

Two models of the Vacu-matic are furnished: one for flow rates of 20 gpm and the other for 40 gpm. Both are compact and space saving in design, intended for quick, easy attachment to present machine tools in the same space usually taken by sump tanks.

Used oil flows by gravity from the machine tool into the Vacu-matic cabinet where a baffled distributor head spreads it evenly across an endless, moving filter belt. This belt is especially woven of nylon, wool and cotton fibers.

A built-in vacuum pump produces a pressure differential in the chamber over which the belt moves. This difference in pressure draws coolant through the belt into the chamber from which it drains into a clean coolant sump. It is recirculated to the machine by the Vacu-matic's built-in coolant pump.

Meanwhile, solid particles which remained on the endless belt are carried forward toward the discharge end of the unit. A vibrator loosens this caked residue just before the radius of the discharge-end roller. Particles drop into a handy, removable tote box for prompt periodic disposal.

Because of the vacuum operation, the announcement points out, Vacu-matic filtering supplies cool coolant. On applications where a 5 to 25 F rise would ordinarily occur, coolant is held substantially at or below room temperature. Furthermore, sludge is de-watered and in powder-dry form when discharged into the tote box. Also the passage of air through the coolant effectively reduces the bacteria count in the coolant. **T-6-1401**

Coating Applicator

The Union Tool Corp., Warsaw, Indiana, has designed a special automatic spreader for applying protective wax coatings to cylinder gaskets. Both sides are coated simultaneously. The coating rolls are felt-covered, the doctor roll neoprene-covered.

Gaskets are fed into the coating rolls by means of piano-wire conveyor which offers a minimum of contact area. The unit is provided with safety reversing switch and explosion-proof controls.

The dimensional and weight specs on this particular machine are as follows: height approximately 47 in., width 80 in. plus drive which extends out an additional 16 in., length approximately 80½ in., weight 4,200 lbs.

T-6-1402

Gear Units

Crown Mitre gear units are compact though powerful mitre gear boxes for transmitting power or motion at right angles.

These units come in two sizes, $\frac{1}{3}$ and 1 hp at 1800 rpm. Each size has both a two-way and a three-way extension with a choice of five mounting facings.

The $\frac{1}{3}$ hp unit has a static torque of 250 inch pounds while the static torque of the 1 hp unit is 750 inch pounds.

Mitre gear units are manufactured by Crown Gear, Inc., 290 West St., Keene, N. H. **T-6-1411**

Calipers

A line of precision vernier calipers is now being distributed by Homestrand, Inc., Larchmont, N.Y.

Re-designed to give users more handling ease, convenience, and accuracy, these precision measuring tools feature three outstanding improvements: fitted, adjustable vernier plates, both measuring scales on the face of the tool and double-spaced vernier graduations.

Thus, not only are readings more easily and more accurately taken, but now, both inside and outside measurements can be taken and read directly—without turning the calipers around.

In addition, the calipers are made of the highest grade, hardened tool steel. The slides are tightly fitted, smooth moving, and open-faced for complete scale visibility. Both scales, graduated in 0.025 inch, have evenly cut lines that are narrow and uniform in width and depth.

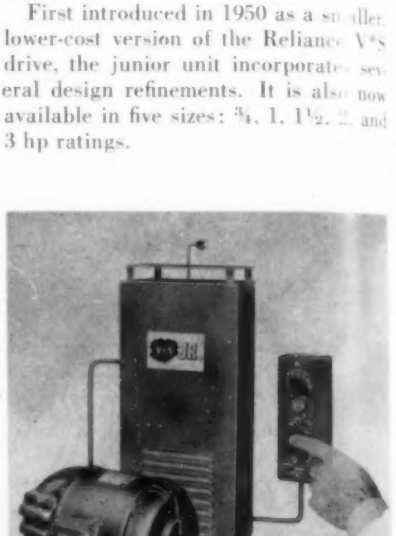
Three sizes are available: 12, 24, and 36 inch.

Included in the line is a 6 inch Mauser type caliper equipped with a built-in depth gage and vernier depth gages in 8 and 12 inch sizes. **T-6-1412**

Adjustable-Speed Drive

Designed to meet needs for adjustable speeds in the lower horsepower ranges in the machine tool and metalworking industries, an all-electric adjustable-speed drive of from ¾ to 3 hp is announced by the Reliance Electric & Engineering Co., 1088 Ivanhoe Rd., Cleveland 10.

First introduced in 1950 as a smaller, lower-cost version of the Reliance V*S drive, the junior unit incorporates several design refinements. It is also now available in five sizes: ¾, 1, 1½, 2, and 3 hp ratings.



The variable-speed drive, providing stepless adjustable speeds from a-c circuits in the range of ¾ to 3 hp, is therefore said to supply a cost-saving answer electrically to the problem of securing greater speed-changing flexibility, application versatility, and control convenience in the operation of a wide variety of machine tools and metalworking production units.

Adaptable for application to existing machines or for installation as an inbuilt, integral unit as original equipment, the drive is suited for powering many different types of machines such as fractional high-speed drills and rotary and cylindrical grinders.

The drive unit is the Reliance heavy-duty type T motor, designed specifically for adjustable-speed service, available in ratings of ¾, 1, 1½, 2, and 3 hp. The operator's control station, housed in a conventional NEMA No. 1 enclosure, provides start-stop buttons, a jog-run selector switch, and a speed adjuster.

The control unit, mounted in a steel cabinet, requires no attention from the machine operator; it may be located on a wall or column in the plant area where it is to be used, in the base of the driven machine, or in a remote location. All three components may be closely associated or widely separated as optimum equipment efficiency may dictate.

T-6-1421

Technical Digests...

Automation Roundup

Progress of the machine tool industry is best represented by special production equipment which has become more and more automatic. These developments have been so successful that today the industry is reaching out for the automatic factory. Machines already in production perform 170 operations on an automotive cylinder block. Advanced designs combining more than five times as many operations are now on the drawing boards.

Success of such efforts depends largely upon ability to control down time. Automatic production lines to be efficient, must be kept in production. Break-downs must be minimized through better coordination of automation elements, and related problems. The first five of the following digests from the Machine Tool Electrification Forum, sponsored by Westinghouse Electric Corp. at Pittsburgh, Pa., April 14 and 15, deal with these considerations.

TELEPHONE SWITCHES APPLIED TO MACHINE CONTROL, *by H. E. Grimes, The Avery Drilling Machine Co.*

With the advent of automation the rotating selector type switch used by the telephone industry is becoming increasingly popular for control of machine tools. There are several kinds of such switches available varying in construction and operation. One is listed as a direct-drive switch because the wipers move directly with the stepping magnet. In another, known as a spring-driven switch *Fig.* 1, the wipers are

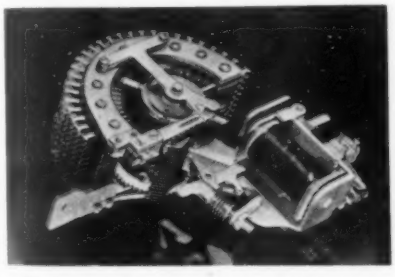


Fig. 1. This versatile switch telephone, type 45, has a maximum of ten levels on a contact bank and can be arranged to give 50 consecutive steps on five levels.

advanced by the action of a spring-driven pawl when the maget is released. A third is a stepping switch which requires few adjustments, *Fig.* 2.

Direct-current power supply, needed for operating these switches, may be half-wave rectification of alternating current with an electrolytic condenser to smooth the output voltage.

To obtain the long and reliable operation that this equipment can provide in machine tool control, several circuit design factors should be observed. The

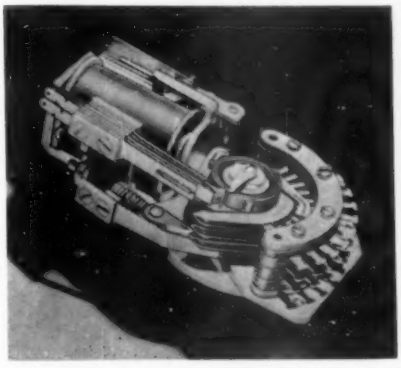


Fig. 2. Smaller and faster in operation than the type 45, this telephone type 44 switch can be arranged to provide 32 or 33 consecutive circuits.

wipers should carry current only when at rest. The switch should be mounted in a tightly gasketed enclosure to exclude the oily, moist atmosphere which is found around machine tools. Since the use of low voltage would increase the current on the wipers, 110-volt control should be used. If necessary to interrupt the current flow with the wipers, the current should be limited to 0.1 ampere—the maximum load should be handled by size 00 relays. The switch coils are not designated for continuous energization, so the control circuit should be designed to hold the coil on "operated" no more than one second.

A spare plug-connected stepping switch should be furnished for all applications to help overcome customer resistance to the use of such equipment.

Due to the nature of their construction, telephone type relays have an inherent wiping action of the contacts. On these relays, parallel contacts are fairly easy to provide and give less trouble than single contacts. With this in mind, one control manufacturer is designing relays having a slight wipe, and optional parallel contacts.

INTEGRATING ELECTRICAL ELEMENTS OF AUTOMATIC MACHINE TOOLS, *by Kurt O. Tech, The Cross Co., Detroit, Mich.*

Recent advances in the machine tool industry have consisted largely of com-

bining more and more machining operations into a single machine. This in turn made necessary provisions for automatic locating, clamping, cutting cycles and automatic material handling.

As machines become more automatic they become more dependent upon new electrical developments to perform the functions previously relegated to human beings. Devices such as information storage devices, memory devices, and the so-called automatic brain are being used and will be used to a greater extent in the future. With them the job of the electrical engineers will become more and more important in the design and development of our machine tools.

To reduce down time, thereby making machines function more efficiently, the electrical engineer must coordinate his work closely with the mechanical design engineer and the hydraulic engineer. Basic decisions affecting all three are, for instance, the choice of either an electric or fluid motor or a limit switch and a four-way valve control as opposed to a sequence valve. Location of various types of controls on and around the machine is another problem.

The control circuit has three elements to be considered: First is the panel mounted controls—motor starters, relays, timers, etc. *Fig.* 3. Upon signal

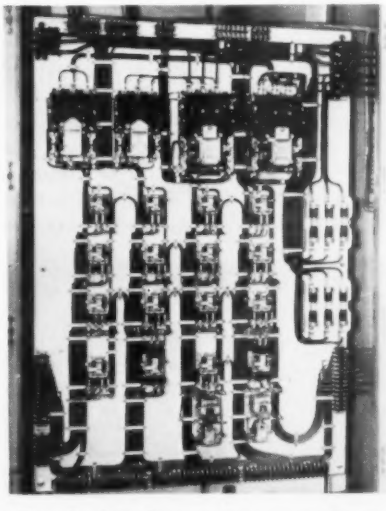


Fig. 3. Panel mounted controls arranged in a logical sequence to tie in with machine operations.

from the machine operated control they actuate electrical devices which in turn actuate hydraulic or electric power means on the machine. Second is the electrical controls mounted on the machine. These include pushbuttons, limit switches, zero-speed switches, etc. which react to manual or mechanical operations to carry signals to control units on the control panel, and also solenoids such as are used to shift spools of hydraulic valves and to operate other apparatus on the machine.

It is in the determination, actuation and location of such controls that the electrical engineer does the most towards an integrated and trouble-free design. The third part of control circuit is the wiring and its relationship to the mechanical and hydraulic design.

Electrical engineering having responsibility for not only the circuit and selection of electrical components, but also for the relationship with any phase of a mechanical and hydraulic design results in better coordination within the engineering department and fewer breakdowns due to poor design.

AUTOMATIC LOADERS FOR CRANKSHAFT LATHES, *by Nelson D. Cooper, R. K. LeBlond Machine Tool Co., Cincinnati, Ohio.*

Crankshaft lathes with automatic loaders make possible a high rate of production. Present machines with automatic loaders are really semiautomatic in operation, however, because they require an operator to perform certain functions. Improvements are now underway to increase production further by making these machines fully automatic.

Due to construction of the lathes the automatic loaders must follow a definite curved path, changing directions in both the horizontal and vertical planes for loading. Another curved path is followed for unloading. This is accomplished by using mechanical motion, hydraulic power and electric control.

Two crank shafts are shown in *Fig.* 4 in position in a 6 AC lathe. Because the shafts are deeply located in the machine, a tremendous advantage is gained by the use of an automatic loader, *Fig.* 5, to unload and load two cranks at the same time.

Electrical interlocking is provided to insure that the loader is in the center position and is inoperative while the

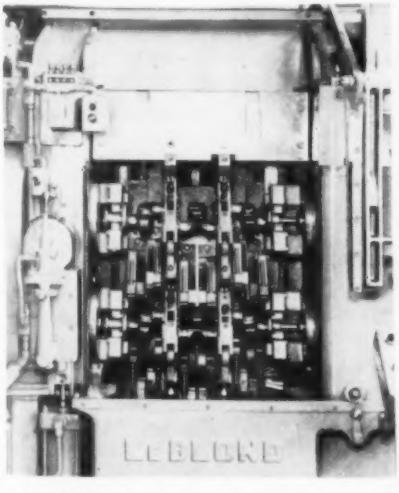


Fig. 4. Lathe set up to machine two crankshafts.

cranks are being machined. Also the machine is inoperative while the loader is in operation. When the loader is operating, it can be stopped in any position by pushing the stop loader button. This de-energizes the main valve only and blocks everything else as is.

A selector switch provides means for selecting either manual or automatic operation of the loader, and when set for manual, each movement of the loader can be operated by pushbuttons.

The control circuit provides means for use of a selector switch to quickly switch from left to right operation or vice versa. This is a requirement of a stand-by machine that must be used in either of two production lines, or with a set of jumpers which can be connected for either right or left-hand operation to suit its position in the line.

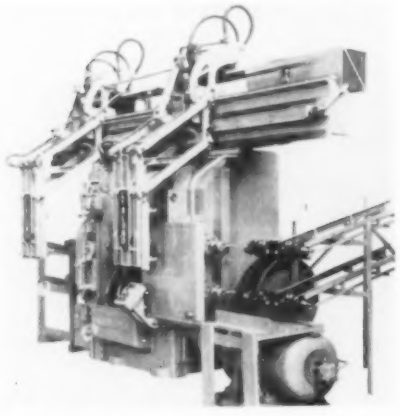


Fig. 5. Crankshaft lathe showing automatic loading mechanism. Note the two sets of hooks on each arm.

THE TRANSFER MACHINE, *by S. Finley I. Rice, The Heald Machine Co., Worcester, Mass.*

Transfer type machine tools are used where high production is required and where many drilling, boring, reaming and similar operations are involved. Such a machine is generally set up with a loading station, several work stations and intermediate stations and an unloading station. A rough part begins at the loading station and is transferred down the length of the machine, stopping at every station where machining operations are performed. Sometimes the part remains idle in intermediate stations.

This type of machine generally consists of a series of separate machines tied together by one long transfer bar which is operated by one or several hydraulic cylinders or equivalent mechanical means. The machine can be divided into sections or units to enable continued production in case of partial machine shutdown. This is accomplished by providing a removable link in the transfer bar and using suitable selector switches to cut out the part of the machine that is down. However, this introduces switching problems and necessitates a duplication of control and safety interlocks.

To facilitate wiring of the machines and to help in trouble shooting when multiple panel control boxes are furnished, it has been suggested that the color of jumper wires between panels in the electric box be different from that which is used for wires going from panels to machine. The JIC recommends use of red wire for all 110 volt a-c circuits, which leaves the machine builder no leeway in providing additional colors for wires which, in his opinion, by color coding would make for easier wiring and servicing.

ADAPTING MACHINE TOOLS TO AUTOMATION, *by R. Juengel, Ford Motor Co., Detroit, Mich.*

With the advance knowledge that machines will be served by automation, machine tool manufacturers could alter their equipment to facilitate design and installation of automatic loading and unloading devices.

All machines, when possible, should be designed as in-line machines. It is impractical to design automation for the "in and out" type of machine, and is impossible as far as high production is concerned. The part should never have to unload by reversing the path through which it loaded.

Application of automation would be facilitated by having the load and unload stations removable. Obstructions should be avoided at the load and unload ends which would interfere with installation and operation of auto-

mating units. These might be protruding air or hydraulic cylinders, chip removal conveyor and drives, extended guide rails, conduit and piping.

Side rail guides should be flared out to provide easy entrance for the automated part. Centerlines of load and unload stations should be definitely located to assist locating machines accurately to dimension. Similarly a construction hole or boss should be provided to locate the part in the first and last index positions.

Machine designers should avoid mechanically trapping the part which is being unloaded. If the machine is shut down with the unloaded part trapped, it is not possible for the automation to cycle. An automation unit should be able to cycle when the preceding in-line machine is shut down.

Access to the machining index stations and tooling should be provided in the body of the machine. This will eliminate the necessity of removing an automation unit to gain access to the stations through the end openings.

Automation requires prints which will show a complete plan and side view with related index station dimensions, and fairly detailed pictures of the load and unload stations. Electrical and hydraulic prints are also required to determine interlocking.

All suggestions will probably not be applicable to every machine but future coordination between machine and automation designers will result in more efficient, economical and reliable operation.

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Titanium Production, *by C. I. Bradford, Director of Operations, Rem-Cru Titanium, Inc., Midland, Pa.*

Until a year or so ago titanium was classed as a rare engineering metal along with tantalum, molybdenum, tungsten and zirconium. As a result of combined efforts of the Government and Industry, tonnage titanium production has arrived. Up to five tons per day of metal and two-ton ingots are being produced. Facilities for 20 tons per day are under construction. Continuous wide strip processing is a reality. Reliable alloys are available in virtually all the standard forms in which stainless steel is produced. Production applications are now established in airframe and jet engines.

It is evident from this review that titanium possesses outstanding physical properties including corrosion resistance, high strength, light weight and ductility. These basically attractive properties are combined with excellent alloying possibilities which still further enhance the metal's properties.

From a paper presented at the SAE 1953 Annual Meeting, Detroit, Mich.

Abstracts of Foreign Literature

By M. Kronenberg

Cold Forming of Turbine Wheel Buckets

Turbine wheel buckets have been manufactured without any machining operation by a deep drawing process according to a report by W. Hoertig in *Werkstatt & Betrieb* #2, 1953. While, as indicated by the author, little is known about the quality of the buckets produced by sintering of powder metals recently used in the USA, it is claimed that a high accuracy of profile and surface finish can be obtained by cold forming of a material called "Nimonic" which contains approximately 20 percent chromium and 80 percent nickel.

The cold forming method requires high skill and careful preparation of the sequence of operations; it is extremely fast although about 30 percent of scrap still occurs but the material can be reclaimed. It is possible to manufacture both types of buckets, that is, the hollow and the solid design. Among the many advantages, in addition to eliminating complex and expensive machining operations on milling machines, the author mentions that only relatively simple and small presses are needed and that no waste of the expensive nickel-chromium alloy occurs. The process depends for its success on the use of a proper lacquer and carbide dies and requires a total of sixteen operations. The "Christmas tree" end of the bucket must, however, still be produced separately.

Metal Cutting Data and Production Cost

The highest cutting speed or the greatest feed rate are not necessarily the most economical from the standpoint of low overall cost of production in a work shop. J. Witthoff, who has made a thorough investigation of the metal cutting factors affecting cost of production, indicates in an article in the October issue 1952 of *Werkstatt & Betrieb*, that a straight logarithmical line relationship between tool life and cutting speed is the only requirement for his conclusions. This requirement is usually fulfilled. The author has thus derived a number of equations which permit him to calculate the cost whereby the following quantities have been taken into consideration: Slope of the cutting speed—tool life relationship, time for changing tools, cost of tools

per grind, hourly wages of operator, overhead of shop or machine, number of tools, ratio of cutting speed to return speed on planers.

In addition, the equations cover machine tools with rotating and reciprocating motion of the spindle or table respectively for cases where a single cutting tool is used and when several equally loaded tools are employed. The case where several unequally loaded tools are used can only be calculated by graphical methods.

It will be of interest to note from the examples given, that cutting speed and tool life that give lowest production cost are different in a small shop and a large factory. Assuming the case of a turning operation with two tools, a depth of cut of 0.2 inch, a feed of 0.024 ipr, a tool-changing time of 4 min, and a slope of the cutting speed-tool life line of 3.8, the author comes to the conclusion that the most economical conditions would be a tool life of 75 min and a speed of 615 fpm when the hourly wages are $1.70 and the overhead factor is 320 percent in a factory. The same job in a small shop should be run at 383 fpm, giving a tool life of 180 min when the overhead factor is 80 percent.

Surface Finish

A meeting on surface finish problems was held by the Association of German Production Engineers *(Arbeitsgemeinschaft deutscher Betriebsingenieure)* in November 1952 at Stuttgart in the US Zone of Germany, as reported in several papers in the March 1953 issue of "Werkstatts Technik & Maschinenbau." H. Moll presented a report on the principles and definitions of precision in relation to the surface roughness obtained by various machining methods. He suggests adopting, as an international standard, the principle that the wear of a machine part must not exceed 50 percent of the tolerance field of two adjacent I-S-A qualities. Accordingly, he has prepared a tabulation for the maximum surface roughness in relation to the tolerance fields, covering diameters from 0.040 inch to 7.2 inches and sixteen classes of ISA qualities.

H. Opitz gave a paper on "Survey of Precision Machining Methods" correlating them with surface finish. As an example, precision turning covers a range of 0.0004 to 0.0001 inch roughness (depth) in the case of carbide turning and a range of 0.00004 to 0.0001 inch in the case of turning with diamond tools. Super fine honing or super fine lapping covers a depth range of roughness from 0.0000002 to 0.0000004 inch. Opitz reported, furthermore, about tests carried out at *Physikalisch-Technische Bundesanstalt* (ap-

proximately equivalent to the U.S. Bureau of Standards) concerning the surface stresses produced by various machining methods and their effect on surface finish.

It was found that electrons are set free by the destruction of the surface layers of a machined part which have been measured by means of Geiger counters. Although these investigations have only recently been started, the comparison of two surfaces of brass parts yielded already interesting results. A surface with a finish of 0.000320 inch produced by grinding, using a feed rate of 68 inches per min radiated about 50 percent more electrons than a surface with a finish of 0.000160 inch. Radiation subsided 12 to 15 hours after machining.

The author discussed also precision machining methods by grinding, lapping, coning, and honing. Other papers presented at the meeting included a discussion of precision milling by H. Detzel, precision grinding by G. Piecha and E. Salje, honing by W. Gehring and G. Kessler, lapping by H. Finkelnburg.

Time Studies

A new edition of the "Refa-Book" on time studies has been published by the Association for Time-Studies, which works in close cooperation with the *V.D.I.* (Assoc. of German Engineers). This book gives a good survey of the methods and standards used abroad by time study engineers and includes also samples for blanks and forms, illustrations of measuring instruments, and other tools employed in time studies. Efficiency, relaxation time and other problems affecting rate settings are covered.

Down Milling in Gear Cutting Operations

The high friction force generated in the case of up milling operations at the start of a cut, causing rapid wear of gear cutters, can be reduced by down cutting methods, according to an article by H. Bohme in #6/1952 of *Fertigungstechnik*. Although the cutting speed had been increased considerably, in the case of down milling, the surface finish and geometrical accuracy had been improved. In addition, the cutting time could be reduced as much as 50 percent to 60 percent. Only when cutting gears having relatively heavy teeth, were difficulties encountered with down milling. The cutter had the tendency to cut too deep into the work caused by backlash.

The author recommends to design gear cutters with backlash eliminators in order to be able to apply down milling more generally to the manufacturing of gears.

Good Reading

A GUIDE TO SIGNIFICANT BOOKS AND PAMPHLETS OF INTEREST TO TOOL ENGINEERS

ELASTICITY IN ENGINEERING *by Ernest E. Sechler. Published by John Wiley and Sons, Inc., 440 Fourth Ave., N. Y. 16. Price, $8.50. 419 pp.*

This book bridges the gap between strength of materials and theoretical elasticity. It brings into one volume the material the engineer needs for a broad background of knowledge based on the fundamental theories of stress and deformation of elastic bodies under load.

The first section of the book establishes the equations and assumptions underlying the whole field of elasticity and collects the basic equations in Cartesian, cylindrical and spherical coordinates which must be used for the solution of elastic problems. Once these basic equations have been derived, the solution of any specific structural problem can be obtained either by the rigorous use of these fundamental equations or by the use of approximate methods of solution.

The second section illustrates the use of these principles in solving the problems of stable (nonbuckling) structures and the third section treats instability (buckling) problems. The last two sections discuss approximate methods of solving problems too complex for formal proof.

A number of examples are included along with many problems. The problems chosen are of a practical nature and illustrate fundamental principles.

ASME SCREW THREAD MANUAL *edited by Henry R. Cobleigh. Published by the American Society of Mechanical Engineers, 29 West 39th Street, N.Y. 18. Price, $2.50; 62 pp.*

This is a manual containing a shop and drafting room abridgment of the American-Unified Standards for screw threads and screw thread gages and gaging.

PROCEEDINGS OF THE THIRD STANDARDIZATION CONFERENCE *held in conjunction with the Centennial of Engineering in Chicago, September, 1952, are available from the American Standards Association, 70 East 45th Street, N. Y. 17. Price is $2.*

PRINCIPLES, ANALYSES AND COST DATA ON MATERIALS HANDLING, *Material Handling Institute, 1108 Clark Bldg., Pittsburgh 22. Price, $0.50.* Thirty-two fundamental principles of materials handling engineering are presented in this 12-page booklet. The manual is designed to help production management to capitalize on the cost savings inherent in improved handling methods, to give materials handling engineers a guide book, and to provide students and teachers with course material.

This is the second booklet in the "Library of Know-How" which is being published by the Industry Educational Committee of the Institute.

MECHANICAL INSPECTION *by W. H. Armstrong. Published by McGraw-Hill Book Co., 330 West 42nd Street, New York 18, as part of the Pennsylvania State College Industrial Series. Price, $5.50; 361 pp.*

The simplified method of presentation of practical material in this manual is designed to train inexperienced men and women as inspectors in machine shops or related industrial shops. It is sufficiently detailed for self instruction, although the primary purpose is for use in class work in technical institutes, vocational schools or with industrial training programs.

The major emphasis is on descriptions of tools which are used for dimensional inspection of machine shop products, and explanations of methods used by inspectors. There are also treatments of hardness testing, Magnaflux and radiographic inspection and statistical quality control.

Topics discussed include blueprint reading, shop mathematics of inspection, inspection discussions including the relationships between mechanical inspection and statistical quality control, surveys of nonprecision and measuring tools used by inspectors, and instruction in the use and care of instruments. A bibliography of audio-visual aids is also included.

DRAFTING BY THE MODEL METHOD *by John B. Musacchia, Henri A. Fluchere and Melvin J. Grainger. Published by the Arco Publishing Co., 480 Lexington Ave., New York 17. Price $3.50 in paper, $5 in cloth; 143 pp.*

Designed as a course in drafting, this book is said to incorporate an entirely new method of instruction using models. Cut-out three dimensional models accompany the text, which is divided into elementary and advanced drafting lessons, ten of each.

Field Notes . . .

Adoption of a revised sales procedure setup has been announced by the Delta Power Tool Div. of Rockwell Mfg. Co. Under the new system, four sales divisions have been set up at the firm's home office; each under a product manager directly responsible to E. W. Ristau, vice-president in charge of power tool sales.

The four product managers are: Ben Eldridge, metalworking division; Thomas C. Mortimer, woodworking division; I. G. Meyer, Homecraft tools division, and A. V. Taylor, accessories division.

Mr. Eldridge has served as service manager and sales training director for Delta. Mr. Mortimer, former district sales manager, has had many years' experience in selling woodworking machinery. Mr. Meyer, former central area regional sales manager has served also as district sales manager and Homecraft sales manager. Mr. Taylor has served as assistant sales manager.

The change is directed toward better service to dealer organizations in the face of expanded operations and increasing diversification of lines. "Each of the product managers, is an expert in the line of power tools for which he will be responsible," Mr. Ristau said.

Government sales under the new plan have been put under the supervision of George Powell. John Claude, well-known figure in the school field, will supervise sales to schools.

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Magnaflux Corp. nearly doubled the size of its plant when it moved to its new quarters at 7300 Lawrence Ave., Chicago. The company displayed the improved facilities to the industry during an open house to celebrate the event. One of the principal advantages is that now all operations are combined under one roof with consequent increased efficiency.

Primary feature of the new facility is the large work area, 74,000 square feet, which will be divided so that more than one-third can be devoted to research, engineering and field engineering service functions, with the remainder set apart for manufacturing. Another main point of the plant is the specially designed, built, and equipped loading and receiving area, designed for convenience and efficiency.

The move is a climax of 25 years in the special field of testing for defects. The company was founded in 1929 when Alfred Victor de Forest developed the Magnaflux method inspection. To further develop and promote the method, he formed a partnership with F. B. Doane who is now president of the firm.

George C. Somes, Jr., manager of Standard Pressed Steel Co.'s New York territory, has been named to the recently created position of manager of sales promotion and merchandising for SPS. Mr. Somes has been with the firm for 20 years.

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The functions and responsibilities of Pioneer Engineering & Mfg. Co.'s purchasing department have been assumed by C. H. Eichman according to a recent announcement from company headquarters.

Expansion in the sales organization at The F. J. Stokes Machine Co. has resulted in the establishment of a Canadian branch in Montreal. The office, located at 1179 Decarie Blvd., is under the managership of J. William Robinson.

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Erection of a million dollar plant at Kenilworth, N. J., for the production of tungsten carbide tools, tool tips, dies, wear parts and powder has been begun by Adamas Carbide Corp. The plant is expected to increase production more than 50 percent of present capacity. Completion is scheduled for December of this year.

A hopeful assist in the direction of offering self aid to the stricken Oriental area is contained in the news that four South Korean engineering schools will receive approximately $22,000 worth of new books on engineering sent by the United Nations' Korean Reconstruction Agency through CARE.

Part of $150,000 worth of new text and reference books that CARE is buying and shipping to war-depleted Korean universities for UNKRA, the engineering volumes represent over 2,000 titles, the headquarters of the agency reports. Ninety percent are American works, with the balance English, French and German titles. Additional Japanese titles in the various book categories covered by the project are being purchased at an overall total cost of $200,000 to provide 50,000 to 60,000 new books for nine universities.

The engineering titles bought were specifically requested by the engineering colleges who will be the recipients: Seoul National, Chun Nam, Chun Puk and Chosun Christian Universities. They will mark the first such book deliveries to Korea since the outbreak of hostilities forced the CARE-UNESCO Book Fund to suspend service to that country. Resumption of service means that individual contributions can again be sent to the fund at any of the agency's offices to provide new engineering and other scientific and technical books for Korean educational institutions. If they desire, donors may designate the category of book to be sent, and the institution to be the recipient.

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One indication of the optimistic feeling in the industry today is reflected in the announcement from Crucible Steel Co. of America. Sales volume and earnings for the company as of April 15 exceed the levels of the period last year. At the same time, W. P. Snyder, Jr., chairman of the board, stated that the current rate of business is expected to hold for the first half of the year.

The same trend was indicated by Diamond Alkali Co.'s announcement of an upswing in its first quarter 1953 sale and earnings. This company, too, forecast a continuation of good business. The release showed that net income after tax provisions indicated approximately two and three-quarter million dollars' increase over the same period last year or 63 cents per share for 1953 as opposed to 47 cents per share last year.

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Four field engineers have been appointed by Bellows Pneumatic Devices of Canada, Ltd., subsidiary of The Bellows Co.; Earl G. Berwick, Manning Otis, Lorne H. Hay, all Toronto territory, and Henry E. Hall, Montreal area.

Among the stocking distributors recently appointed by Scully-Jones and Co. are Dayton Supply & Tool Co., 520 E. First St., Dayton 1, Ohio; W. C. Chapman and Sons, 1817 Maryland Ave., Baltimore, Md.; and the Shop Supply Co., 2414 Second Ave. N., Birmingham, Ala. These distributors, who will carry local stocks of Scully-Jones tools, are being named to facilitate improved service to industries in their sections of the country, the company announcement said. Dayton Supply & Tool will cover Dayton, Springfield, Piqua, Middletown, Hamilton, Sidney and Mechanicsburg, Ohio. Chapman & Sons covers the state of Maryland and the District of Columbia; and the Birmingham firm will serve the state of Alabama. Sometime after June 1, the Baltimore firm expects to move to new quarters at 4705 Erdman Ave.

Other representatives listed in the new appointments of stock distributors for Scully-Jones, included Gurley-Ortman Indiana, Inc. 1707 E. 52nd St., Indianapolis, will serve that city as well as Evansville, Richmond, Terre Haute, Muncie and Anderson, Ind. and Louisville, Ky. Cummings and Co., 115 E. Lewis St., Wichita, Kansas will cover western Kansas. Patrick H. Dillon Co., 524 Howard Ave., New Orleans will deal with a territory covering the southern half of Louisiana, in addition to Pearl River, Stone, Georgia, Hancock, Harrison and Jackson counties in Mississippi.

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Reid Precision Surface Grinders has appointed the Lafayette Tool and Supply Co., 3355 N.W. 27th Ave., Miami as dealer in that area.

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The Hy-Pro Tool Co. has announced the addition to its staff of two direct factory representatives. Harry B. Hubbard, whose headquarters will be in Kensington, Conn. will serve the state of Connecticut; while Earl C. Jex, Jr., operating out of their Detroit office at 10428 W. McNichols Rd., will cover the state of Michigan.

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Capital stock of The Ross Carrier Co. has been acquired by Clark Equipment Co. Michigan Power Shovel Co., a subsidiary of Ross Carrier is included in the transfer. According to announcement of the transfer, production and administration of both the acquired firms will be integrated with activities of the Clark organization. Reasons given for the purchase was that it enabled Clark to add established products in related equipment to its materials handling lines, and also permitted the firm immediate and expanding future opportunities.

A West coast representative has been appointed by the American Pullmax Co., Inc. as a result of the growing demand from the western metalworking industry. Paul Gray, 240 N. Reno St., Los Angeles, has been assigned to fill the position.

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A Des Moines, Iowa, branch office has been opened by the general machinery division of Allis-Chalmers Mfg. Co. in the Savings & Loan Bldg., 206 Sixth Ave. The branch will be under the management of Edward A. Rensch, formerly sales representative at the Davenport office.

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A. Milne & Co. has moved its Cleveland warehouse into new quarters which is effectively an expansion of its facilities by 50 percent. Address of the new building is 11110 Avon Ave., Cleveland.

Albert G. Lindsay, former manager of Crosley Corp.'s Foreign Div., has been named manager of the Export and International Divs. of Rockwell Mfg. Co. He will make his headquarters at 400 N. Lexington Ave., New York.

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Sales and Service Machinery Co. 3818 Chestnut St., Philadelphia, has been made sales representative for The R. K. LeBlond Machine Tool Co. in Eastern Pennsylvania, Southern New Jersey, Maryland, District of Columbia and Delaware.

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The Cleco Div. of the Reed Roller Bit Co. has named several distributors for its products throughout the country. They include F. C. Bishop Co. in Buffalo, Flood and Calvert, Inc. in Galveston, and Paterson Machinery Co. in Nashville, Tenn.

North East West South IN INDUSTRY

Joseph L. Greenens, formerly superintendent of the Alnico permanent magnet section of Carboloy's operations in Schenectady, N.Y., has been appointed manufacturing superintendent of the Edmore, Mich., plant of **Carboloy Dept.,** General Electric Co. He will be responsible for all manufacturing activities at the new plant.

The board of directors of **Scovill Mfg. Co.** recently re-elected **Leavenworth P. Sperry** to his ninth consecutive term as president.

The **Doerr Electric Corp.** has announced three additions to its staff. Karl A. Blind has been named assistant to the president. His duties will deal mainly with development of new products. Carl F. Kowal, who has been associated with the Louis Allis Co. for 13 years in research and design work, has been made assistant sales manager at Doerr. William F. Boerger has been appointed service manager, following extensive experience with Delta Power Tool Div., Rockwell Mfg. Co. where he acted in a similar capacity.

According to company announcement, **George Bennett** has been elected executive vice-president and general manager of **The Harold F. Howard Co.,** industrial and management engineers. Mr. Bennett has been vice-president and chief engineer since early in 1948. He is a senior member of ASTE's Detroit chapter.

J. Donald Clark has been named general manager and **George Nessenthaler** has been appointed works manager of the three plants in Philadelphia and Ellwood City, Pa., according to a recent announcement from the **George K. Garrett Co.** Mr. Clark, who has been with Garrett since 1939, will coordinate manufacturing purchasing, sales and shipping. Mr. Nessenthaler, who was one of Garrett's first employees, joining in 1933, will be responsible for maintaining quality and production in the company plants.

Robert T. Frisbie, Jr. has been elected vice-president of **The New Britain Machine Co.** He formerly was sales manager of the company, responsible for coordinating sales effort of all outside company representatives.

R. T. Frisbie, Jr.

C. M. Beach

Carl M. Beach has been elected a director and vice-president of **Cincinnati Milling and Grinding Machines, Inc.,** sales subsidiary of The Cincinnati Milling Machine Co. Mr. Beach, who has been with the firm since 1929, was formerly its domestic sales manager.

According to a recent announcement, **John D. Thompson** has been elected executive vice-president of **Henry Disston & Sons, Inc.** Mr. Thompson has been a vice-president of John A. Roebling's Sons Co. in charge of operations.

Two engineers prominent in the lift-truck field have joined **Clark Equipment Co.'s** Industrial Truck Div. **John A. Borman,** associated with Clark from 1946 to 1950 has returned as assistant to the vice-president on engineering and production problems. **Russell Hastings,** who was with Lewis-Shepard Co. for 18 years, joins Clark as assistant to A. O. Williams in directing activities of the engineering staff.

Following a recent meeting of the board of directors of **Raybestos-Manhattan, Inc.**, announcement was made of the election of **W. S. Simpson** as vice-president in charge of the Raybestos Div., and the appointment of **M. A. Thompson** as assistant comptroller of the corporation. At the same time, **J. H. Merrell**, vice-president, Western sales division at Chicago, was awarded the company's 50 year service pin.

James Gerity, Jr., president of Gerity-Michigan Corp., has been elected a member of the board of directors of **Schultz Die Casting Co.** One of the founders of the firm, and secretary since its organization, the election marks resumption of his directorship, a position he relinquished in 1951.

The Chandler-Evans, Div. **Niles-Bement-Pond Co.** has appointed **Louis G. Burns** as chief pump engineer. Maj. Burns is widely known in the aviation industry having specialized in fuel systems and pumps for 15 years.

William O. Wilson, commercial vice-president of **Worthington Corp.** has retired after 53 years of service with Worthington and its predecessor companies. Since 1944, Mr. Wilson has been responsible for general supervision and direction of all the firm's commercial activities in Chicago, St. Louis, Kansas City and St. Paul district territories.

Samuel B. Casey has been elected to the board of directors of **Elastic Stop Nut Corp. of America**, replacing his brother who died recently.

OBITUARIES

Carl E. Johnson, prominent California manufacturer, died recently at his home in San Marino. He would have been 70 years old in October. Mr. Johnson was one of the founders of **Sterling Electric Motors, Inc.**, as well as organizing the first company on the West Coast for the manufacture of electric motors and generators. He made a great number of technical contributions to the electric motor field and was directly responsible for about 30 patents for various developments.

J. Gordon Turnbull, consulting engineer for the design and construction of many major industrial and military installations including Ford Motor Co.'s River Rouge plant, General Motors plants and the Knolls Atomic Laboratory, died recently following an extended illness. He was founder and president of J. Gordon Turnbull, Inc., but had been inactive for the past year.

Myron S. Curtis has been made engineering vice-president of **Warner & Swasey Co.** He has been a director of engineering since 1948. Mr. Curtis' carreer with Warner & Swasey, which began 13 years ago, has included work with the planning committee, service as assistant director of engineering, and as a member of the board of directors.

Four promotions involving top personnel in its technical departments have been made by **Elgin National Watch Co., C. N. Challacombe** has been named assistant director of research. Dr. Challacombe, former professor of physics at Baker University, has been chief product development engineer at Elgin. **Earl H. Schaefer** has been promoted to head the entire engineering department. Mr. Schaefer, who joined the company in 1941 was previously chief manufacturing engineer. **Max Favret** becomes technical coordinator for the company. He came to Elgin in 1949 from Switzerland where he was chief engineer at the Langendorf Watch Factory. **Richard W. McCornack** moves to the position of chief production engineer. He has been a member of the firm's production engineering department since 1946.

Technical Shorts . . .

INFORMATION ABOUT a highly efficient process which results in the simultaneous production of both an important industrial solvent and a basic raw material, used in the manufacture of a wide variety of chemicals and plastics, has been made public by Detrex Corp.

The announcement was made by A. O. Thalacker, president of Detrex, manufacturer of industrial cleaning equipment and chemicals, and vice-president of Hooker-Detrex, Inc. The same company originally developed the stabilizing process which is credited with making trichlorethylene commercially practical.

Mr. Thalacker said the new process was developed for the manufacture of trichlorethylene, widely-used metal-cleaning solvent. It also results in the simultaneous manufacture of hydrogen chloride.

Perfection of the process came about after intensive, six-year program carried out jointly by the research laboratories of Detrex and Hooker. Pilot plants producing both trichlorethylene and hydrogen chloride were first set up in both Detroit and Niagara Falls in 1947.

An attendant advantage to industry is that production of hydrogen chloride in the new manufacturing process opens up a completely new source for this vital material. It will come from the process as a pure gas in a pipeline ready for use as a raw material in the manufacture of plastics.

The new process will be installed in the Ashtabula plant, and conversion is expected to be completed by April, 1954, the Detrex official said. There will be no interruption in the production of trichlorethylene at the time of the changeover to the new process, he declared.

Manufacturing operations at the Hooker-Detrex Ashtabula plant will continue to be under the supervision of the Hooker Electrochemical Co., of Niagara Falls, N. Y., well-known chemical manufacturer. Hooker-Detrex, a New York corporation, is jointly owned on a 50-50 basis by Detrex and Hooker Electrochemical.

As an interesting sidelight, the General Tire & Rubber Co. recently announced it will construct a vinyl chloride plant on property adjacent to Hooker-Detrex at Ashtabula. Mr. Thalacker said present plans call for transmission of all hydrogen chloride produced by Hooker-Detrex to the General Tire plant through pipelines.

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AFTER THREE YEARS of testing under extreme corrosion conditions, a new system of anticorrosion coating, using specially formulated neoprene coatings, has been introduced by The Pennsylvania Salt Mfg. Co.

The system, as reported by Pennsalt maintenance engineers, has resulted in savings up to 50 percent per square foot in the maintenance painting and coating costs in the company plants.

The special formulations, added to Pennsalt's regular line of corrosion resistant paints and cements,, are NeoCoat and NeoPrime A (for all surfaces except concrete) and NeoPrime B (for concrete surfaces).

NeoCoat is a true plastic, involving polymerization, in which the accelerator is included in the product, thus eliminating the necessity of mixing on the job. The polymerization takes place after the coating is applied.

The special formulation of this coating was developed as the result of Pennsalt's tests and experience in its own plants. In these tests it was found that to stand up in service, a coating had to be built up to a thickness of at least 5 mils, regardless of its corrosion resistance, and had to be especially effective in covering welds, beads, seams and edges where coatings most frequently failed.

It was also found that it is uneconomical, from the labor and time standpoint, to apply more than three coats, including the primer. Therefore, NeoPrime and NeoCoat were formulated to attain the proper thickness within three coats.

While testing a wide variety of possible formulations, the engineers found the NeoCoat and NeoPrime formulations to be the most effective under the widest variety and severest corrosion conditions. In addition to developing the new coatings themselves, it was also necessary to work out practical methods of surface preparation, application and maintenance.

R. R. Pierce, manager of Pennsalt's Corrosion Engineering Dept., explained his company's entrance 21 years ago into the field of corrosion engineering initially as an attempt to solve its own corrosion problems. These covered a wide variety of operations involving various strengths of hydrofluoric and sulphuric acids, persulphates, ammonia, peroxides and many other highly corrosive chemicals. "Corrosion still remains one of the costliest problems in industry," he stated. "We feel the development of these products and this system is the most successful step we have taken to date in overcoming these problems."

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THE FIRST COMMERCIAL production in the USA of optical quality fused quartz used in electronic computers, scanners and for other special optical and electronic requirements, has been announced by Dr. J. H. Laub, executive vice president of Hanovia Chemical & Mfg. Co., a unit of the Engelhard Industries.

The new quartz, of very high optical quality, will be manufactured on a production basis by Optosil, Inc., of Hillside, N. J., a recently formed subsidiary of Hanovia. Vital in both civilian and defense production, optical quartz, involving new and difficult fusing processes, previously was manufactured commercially only in Europe, according to Dr. Laub.

The basic processes for production of optical quartz was acquired from Heraeus Quarzschmelze Hanau, the company which originated them. Dr. Laub

explained that their methods make possible the manufacture of a quartz exceptionally homogeneous and subject to minimum of strain and striation.

Full scale commercial production is scheduled to begin in the near future. As a consequence, the company anticipates being able to meet, in an extensive way, the needs of the electronic industry and of the optical field for fused quartz. Full-scale commercial production is scheduled to begin shortly.

Commenting on the introduction to the American market of domestically made optical fused quartz, Dr. Laub observed: "It will make available to American industry increased quantities of a new and highly important type of fused quartz that combines economy with the highest quality. Even more important, perhaps, is the fact that it marks an important step in freeing this country from dependence on foreign producers for its supply of a vital industrial material."

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A MOLYBDENUM DISULFIDE dispersion particularly designed for the lubrication of side seamer chains in tin can manufacturing, has been announced by The Alpha Corp.

The lubrication of these side seamer chains has been considered among the most difficult lubrication problems in the can manufacturing industry. Because of this difficulty, the chains were often operated without lubrication and allowed to run to destruction. The high cost of replacing these chains, together with the production losses attending the replacement, spurred development of a lubricant designed to overcome these difficulties. Results were centered in Molykote M-10.

During the past 18 months, in cooperation with one of the major can manufacturing companies, exhaustive tests have been made on four side-seamer chains installed in four different east coast factories. These chains were of standard construction, but a film of Molykote, Type Z, powder was bonded to the pins, bushings and rollers before assembly.

Every 40 operating hours the chains were allowed to cool down to a temperature of 150 F to 200 F and Molykote M-10 was brushed on. The carrying agent colatilized quickly leaving a film of powder on the pins, bushings and rollers.

After 18 months of operation, tests revealed that wear on the pins was negligible and that the chain remained clean over the period without any build-up of lubricant substance on the surfaces. It is estimated that the use of this procedure will extend side seamer chain life as much as 400 percent.

FILM STRIPS on arc welding for use by instructors to introduce students to the welding process, welding equipment and where and how it is used, is now available through the Lincoln Electric Co. of Cleveland, Ohio. Presented in a series of three strips, which are produced in full color and with a supplementary manual, it is designed for the instruction of high school students, vocational trainees, technical apprentices and farmers in the fundamentals of arc welding.

The series, called *Arc Welding*, consists of these fifty-frame strips: "Electric Arc Welding and How It Helps Man," "Selecting and Using Arc Welding Equipment Safely," and "Practicing Arc Welding." Produced to be an aid to all persons instructing welding, it offers a visual presentation of the historical development of welding, how the process works, what equipment is needed and how it is used. Color photographs and art work help to clarify the details to the viewer. Preliminary steps in making basic joints are illustrated with particular emphasis on safe welding practices.

Close-up photographs of the welding arc in action show in step-by-step fashion how to hold and move the electrode as well as how to prepare and make welded joints in several welding positions.

Information on availability and cost may be obtained from Lincoln Electric Co., who prepared the story in cooperation with the Audio-Visual Div. of Popular Science Publishing Co.

* * *

INTERNAL GRINDING is the subject of a 30-minute sound, color movie entitled "Allignment for Better Internal Grinding." It is a semi-technical discussion for supervisory and management groups of the underlying, fundamental principles and at the same time some basic information on alignment of the internal grinder not previously available.

Work finished on an automatic, semi-automatic and a toolroom machine (in the latter case to a tolerance of 20 millionths on diameter and a surface finish of 2 microinches) are shown as examples to illustrate various points emphasizing necessity of alignment.

The film shows elements which contribute to the alignment, pointing out their correct relationship; and in addition, shows the types of misallignment to which each element is subject. Models make it possible to give a clear picture because of motion.

The movie is offered on a loan basis by the people who made it; the Bryant Chucking Grinder Co., Springfield, Vt.

TRADE LITERATURE

Free Booklets and Catalogs Currently Offered By Manufacturers

Saws

Twenty-four page manual on cutting applications with a portable power saw lists 30 different materials and the most effective method of cutting them. Includes information on proper blade selection, cutting techniques plus hints and suggestions for easier and better results. **Skil Corp.**, 5033 Elston Ave., Chicago 30. **L-6-1**

Induction Motors

Specification tables, drawings, charts and photos illustrate leaflet describing line of Dripproof induction motors, their operation and efficiency. Covers recent changes in design and their consequent advantages. The Lima Electric Motor Co., Dept. 139, Lima, Ohio. **L-6-2**

Fixture Clamps

Sixty-four page catalog of line of fixture clamps and components includes 15 styles in 100 sizes and more than 350 fixture components. The West Point Mfg. Co. 26935 W. 7 Mile Rd., Detroit. **L-6-3**

Hardness Testers

Twenty-page illustrated catalog covers line of portable hardness testers; explains hardness tester procedure, testing in the Rockwell scales, methods of testing and the advantages of the portable tester. Photos showing tester in use clarifies the operation. **Ames Precision Machine Works**, Waltham, Mass. **L-6-4**

Riveting

Two revised booklets on riveting are the Anchor Bushing Catalog and "Riveting with Hi-Shears." Both are extensively illustrated with drawings to show in detail all phases of the operations in all types of applications from preparation to completion. Especially adaptable to use for classroom or training departments. **The Hi-Shear Rivet Tool Co.**, 8924 Bellanca Ave., Los Angeles 45. **L-6-5**

Stamping Production

Bulletin 15 presents Multi-Slide machines designed for automatic high-speed production of precision metal stampings from coil stock; explains principle of operation, applications, main features of design and advantages of use. Includes specification tables, photos, dimensional and engineering drawings. **U. S. Tool Co., Inc.**, Ampere (East Orange), N.J. **L-6-6**

Dust Collector

Six-page folder, No. 915, describes "CH-3" self-cleaning cloth screen dust collector. Drawings and diagrams illustrate special engineering features and its principle of operation through reverse air flow. **Pangborn Corp.**, Hagerstown, Md. **L-6-7**

Heat Treating

Folder No. HT-53 pictures line of heat-treating furnaces and ovens in actual use; includes car bottom, batch, conveyor and special type ovens and pit type furnaces. **The Carl-Mayer Corp.**, 3030 Euclid Ave., Cleveland 15, Ohio. **L-6-8**

Metal Hose

A compact but complete data book includes information on application, temperature ranges of various types of metal and wire braided hose, dimensions, couplings, assemblies, etc. Well illustrated. Aimed at answering questions of both the engineers and purchasing agents. **Universal Metal Hose Co.**, 2133 S. Kedzie Ave., Chicago 23. **L-6-9**

Testers

Bulletins D 4, 2 and LR2 offer engineering information on the Dillon Dynamometer, Model L and low range testers; well illustrated, show testers in action in various capacities, give specific data and specification tables, outline advantages, and list typical users of each type tester. Also include price lists. **W. C. Dillon & Co., Inc.**, P. O. Box 3008, Van Nuys, Calif. **L-6-10**

Cleaning, Glass Molds

How to perform cleaning operations on glass molds without destroying close tolerances is discussed in bulletin No. 53 on wet blasting. Shows in detail how the operation is done, stressing savings in time and labor. **American Wheelabrator & Equipment Corp.**, 1182 S. Byrkit St., Mishawaka, Ind. **L-6-11**

Drills

Convenient wall chart consolidates fractional, wire, letter and millimeter sizes into one consecutive listing in numerical order of their decimal equivalents for convenience of specifying drills. Covers range of 327 drill sizes from 0.0135 to 1.000 in. diameter. **Ace Drill Corp.**, Adrian, Mich. **L-6-12**

Pumps

Catalog 5001 gives complete description and latest specification data on entire line of pumps, valves, cylinders, power units, transmissions and control devices for oil hydraulic operation of industrial machinery. Industrial Products, **Vickers Inc.**, 1416 Oakman Blvd., Detroit 32. **L-6-13**

Welding

Illustrated 28-page catalog deals with line of welding equipment including torches, tips, burners, etc. Weldit, Inc., 990 Oakman Blvd., Detroit 6. **L-6-14**

Valves

Brochure covers series of recently designed valves developed for industrial applications where ammonia and other gases, noncorrosive to steel, are used. Includes numerous illustrations as well as specification tables and operation data. **Henry Valve Co.**, 3215 N. Ave., Melrose Park, Ill. **L-6-15**

Lathes

Twelve-page catalog No. 5216 deals with company's Light Ten lathe; widely illustrated, shows outstanding features of both bench and floor types in quick change gear and toolroom models; gives complete specifications. Includes information on attachments and accessories. **South Bend Lathe Works**, 425 E. Madison St., South Bend 22, Ind. **L-6-16**

Drilling

Catalog AD 723, "Air-Powered Hydraulic Drill Unit" contains extensive engineering data giving comprehensive coverage of operation, capacity, available drive arrangements and power regualtion of line of hydraulic drill units. Includes charts permitting quick analysis of proper gear ratio, pulley drive and motor needed for specific operation. Also covers engineering accessories available for the units. **Delta Power Tool Div., Rockwell Mfg. Co.**, Dept. DC-H40, 400 N. Lexington Ave., Pittsburgh 8. **L-6-17**

Indexing

An indexing mechanism designed to replace Geneva drives and other indexing devices is pictured and described in Bulletins No. 101, 102 and 103 pertaining to the Ferguson roller gear drive. Explain characteristics of the drive, how to determine type drive necessary for individual operating requirements, and information on selection for specific case. **Roller Gear Div., Ferguson Machine & Tool Co.**, P. O. Box 191, St. Louis 21, Mo. **L-6-18**

Instrument Control

Catalog 1053 describes Brown Millivoltmeter type instruments including indicators, indicating electronic controllers and excess temperature safety cutoff controllers. Covers operating information on operation and applications; includes data on primary measuring elements, dimensions, and scale selection tables. **Minneapolis-Honeywell Regulator Co., Brown Instruments Div.**, Wayne and Windrim Aves., Philadelphia 44. **L-6-19**

Who's Meeting - and Where

May 31-June 3. American Gear Manufacturers Association. Annual meeting, The Homestead, Hot Springs, Va. Write to association headquarters, 33 W. 39th St., New York 18, for particulars.

June 1-12. Canadian International Trade Fair. Sixth annual show, Canadian Exhibition Grounds, Toronto. Contact Canadian Government Exhibition Commission, Mr. Glenn Bannerman, Director, Exhibition Grounds, Toronto, for complete details.

June 6-12. The Society of the Plastics Industry, Inc. Sixth national plastics exposition, Cleveland Auditorium, Cleveland. More information is available from the society's offices at 67 W. 44th St., New York 36.

June 8-9. Malleable Founders Society. Annual spring meeting, The Homestead, Hot Springs, Va. Contact society office, 1800 Union Commerce Bldg., Cleveland, for particulars.

June 11. Standards Engineers Society. Meeting in New York. Write society office, c/o P.O. Box 281, Camden 1, N. J., for complete information.

June 11-12. Machinery & Allied Products Institute. MAPI Washington Conference, Statler Hotel, Washington D.C. For more information write Institute office, 120 LaSalle St., Chicago.

June 15-19. American Electroplaters' Society. Annual meeting, Benjamin Franklin Hotel, Philadelphia. Society headquarters, 445 Broad St., Newark, N. J., can provide details.

June 15-19. Basic Materials Conference and Exposition. First conference, Hotel Roosevelt, exposition for industry at Grand Central Palace, New York City. Full information available from Banner & Greif, 250 W. 57 St., New York 19.

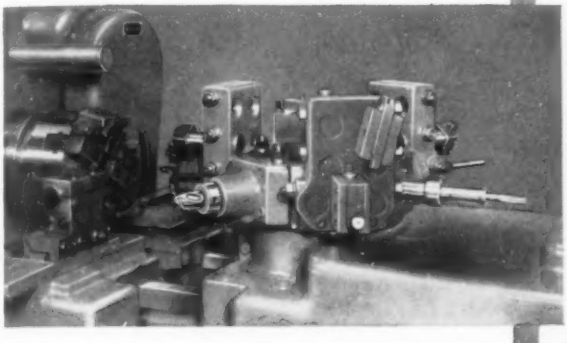
June 15-19. American Institute of Electrical Engineers. Summer general meeting, Chalfonte-Haddon Hall, Atlantic City, N. J. Obtain full information from institute offices, 33 W. 39th St., New York 18.

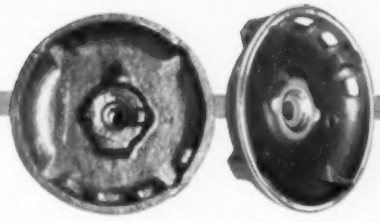
June 16-19. American Welding Society. Exposition, Shamrock Hotel Hall of Exhibits, Houston, Texas. Additional details may be obtained from society's management office, Suite 1006, 12 E. 41st St., New York 17.

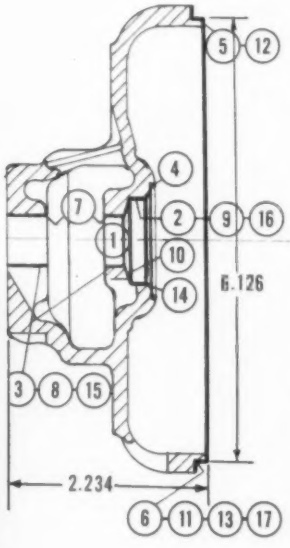
June 28-30. Alloy Casting Institute. Annual meeting, The Homestead, Hot Springs, Va. Get details from institute headquarters, 32 Third Ave., Mineola, N. Y.

HOT CLAIMS . . .
ACTUAL FACTS!

17 Operations in 1.85 Minutes







FIRST TURRET FACE
1 Spot Drill Hole
2 Rough bore 1.125" counterbore

SECOND TURRET FACE
3 Core drill hole through
4 Machine two pads at front of hole
5 Rough face end at rim
6 Rough face and form turn 6.126" diameter

THIRD TURRET FACE
7 Break corners at core in center of hole (Slide Tool)

FOURTH TURRET FACE
8 Finish bore hole
9 Finish bore 1.125" diameter
10 Counterbore and form bevel at bottom
11 Finish turn 6.126" diameter
12 Finish face end
13 Finish face shoulder
14 Chamfer

FIFTH TURRET FACE
15 Ream hole .6245" diameter

SIXTH TURRET FACE
16 Ream counterbore 1.125" diameter
17 Size turn 6.126" diameter

SURFACES MACHINED ARE INDICATED BY HEAVY LINES

with a 3 U SPEED-FLEX Automatic Turret Lathe PLUS P&J TOOLING

Machining this cast iron motor bracket in just 1.85 minutes isn't a special record run for a 3U Speed-Flex, but another example of the fast, accurate work you can expect day in and day out from a P & J Automatic *plus* P & J Tooling on almost any job requiring a high output of small, precision parts.

Check your present equipment; if it can't match this performance, you're missing big opportunities for lower unit costs, divided labor costs — and a better all 'round profit and production picture.

Find out more about production the P & J way. Send today for your copy of the P & J 3U Bulletin No. 145 — or ask experienced P & J Tool Engineers to submit tooling recommendations based on your own prints or sample parts.

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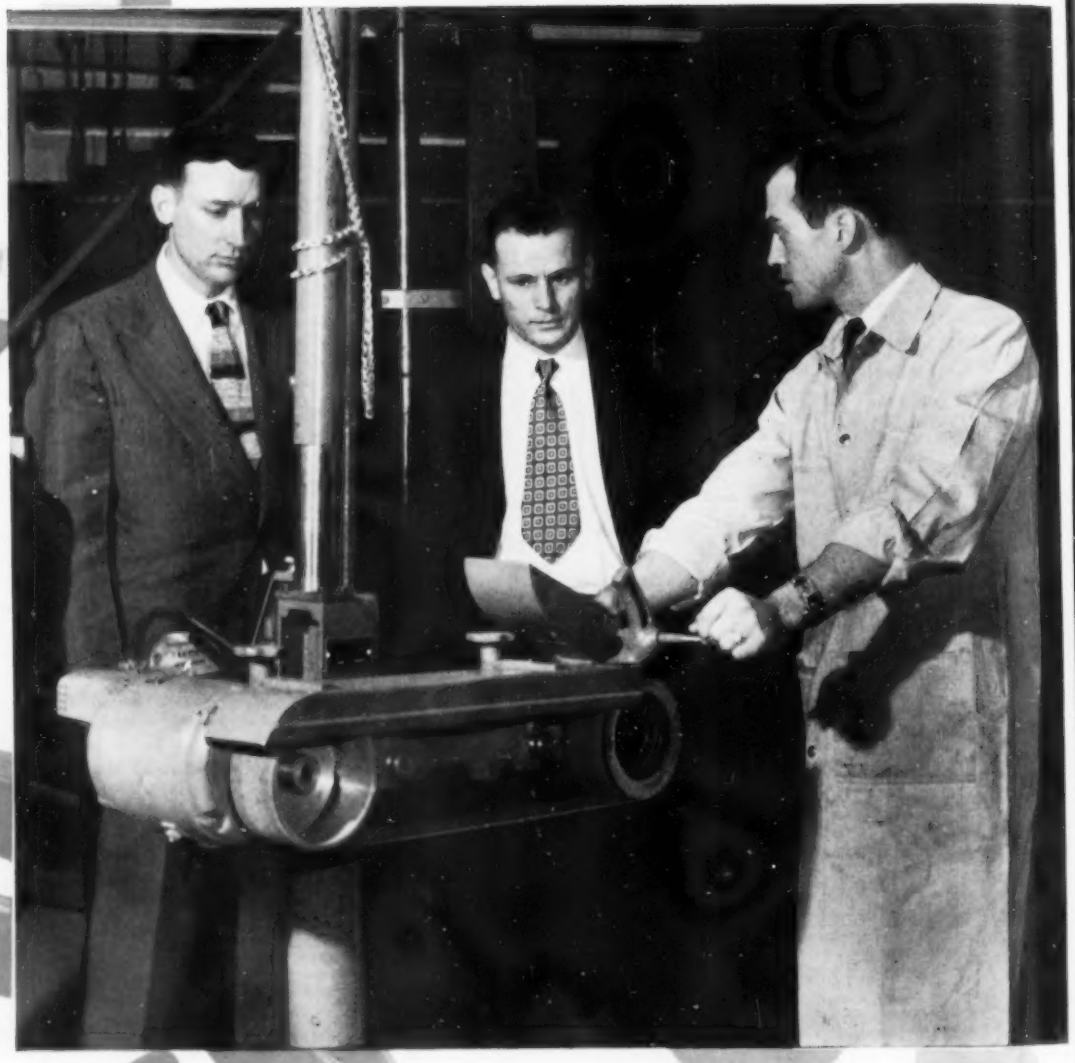
P&J

Don't guess about
Get the FACTS you



COATED ABRASIVES need from a specialist!

YOU CAN CUT COSTS . . .

and production time by the right choice of Coated Abrasives.

Be sure to get the right facts about coated abrasive applications from the man who specializes in knowing *all* about *all* coated abrasives — the BEHR-MANNING Field Engineer.

He is your best bet to insure against handicapping your output with methods that were good yesterday but are outmoded today — because BEHR-MANNING leads in coated abrasive research . . . because BEHR-MANNING offers the widest range of coated abrasive products, totaling over 30,000 . . . because BEHR-MANNING places at your disposal a fund of coated abrasive knowledge and practical experience that is unmatched. And because your BEHR-MANNING Field Engineer is in every sense of the word a specialist who makes a full-time job of bringing to your operations the latest work in coated abrasive "know-how."

The service of your local BEHR-MANNING Field Engineer is yours entirely without obligation. The same is true of the nearest fully equipped BEHR-MANNING Coated Abrasives Methods and Equipment Demonstration Room where other specialists are ready to help you determine by actual trial the right coated abrasives to use on your parts and the best method of applying them. Use these services and be sure of the latest word in coated abrasive products and procedures.

Get this "case study" packet

"Blueprints for Faster, Better Production", containing a group of typical cases where coated abrasives, correctly applied, have stepped up production. Write today to Behr-Manning Corp., Troy, N. Y., Dept. TE-6

For Export: Norton Behr-Manning Overseas Inc., New Rochelle, N. Y., U. S. A.

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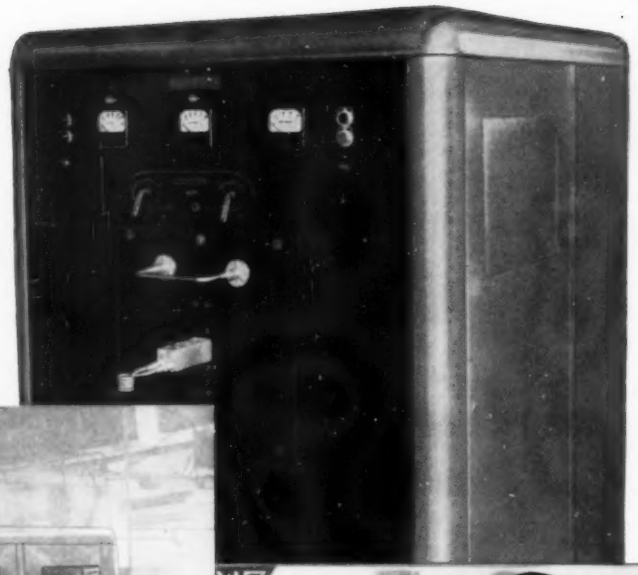
division of NORTON Company

- COATED ABRASIVES
- SHARPENING STONES
- PRESSURE-SENSITIVE TAPES

AT WENDT-SONIS

A LINDBERG INDUCTION HEATING UNIT



ups tool tip brazing 135% . . . replaces two units

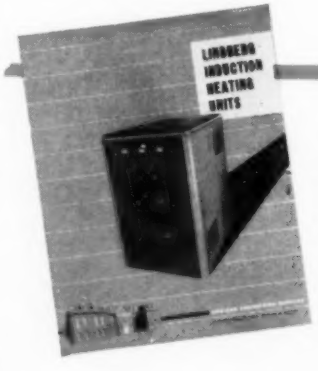
Production brazing of carbide tip tools has soared from 270 to more than 600 an hour since Wendt-Sonis, Hannibal, Mo., tool manufacturer, installed a Lindberg induction heating unit.

Two operators, fluxing parts and putting brazing metal and carbide tool tips in place, load the assemblies on a conveyor belt that passes a continuous stream of work through a specially designed, long hair-pin type heating coil.

Production is speeded because 14 tool assemblies . . . not just one . . . are in the heating field at any given time. The first tool on the conveyor passes *from* the heating area, leaving 13 others *still in* the field of heat, with tool number 15 *just entering* the coil area.

Production, formerly through two smaller units, totalled only 135 tools per hour, per unit, and required four operators. Thus the new equipment frees two operators for other important work.

If your requirements call for production brazing, soldering, hardening, annealing, stress relieving, hot forming, forging or shrink fitting, a Lindberg induction heating unit can better your production picture . . . minimize costs . . . increase profits.



Ask for a copy of Bulletin 1440. It pictures and describes standard models . . . illustrates 11 cost reducing features . . . lists applications . . . shows accessory equipment.

LINDBERG *HIGH FREQUENCY DIVISION*

Lindberg Engineering Company, 2452 West Hubbard Street, Chicago 12, Illinois

IN A HOLE?

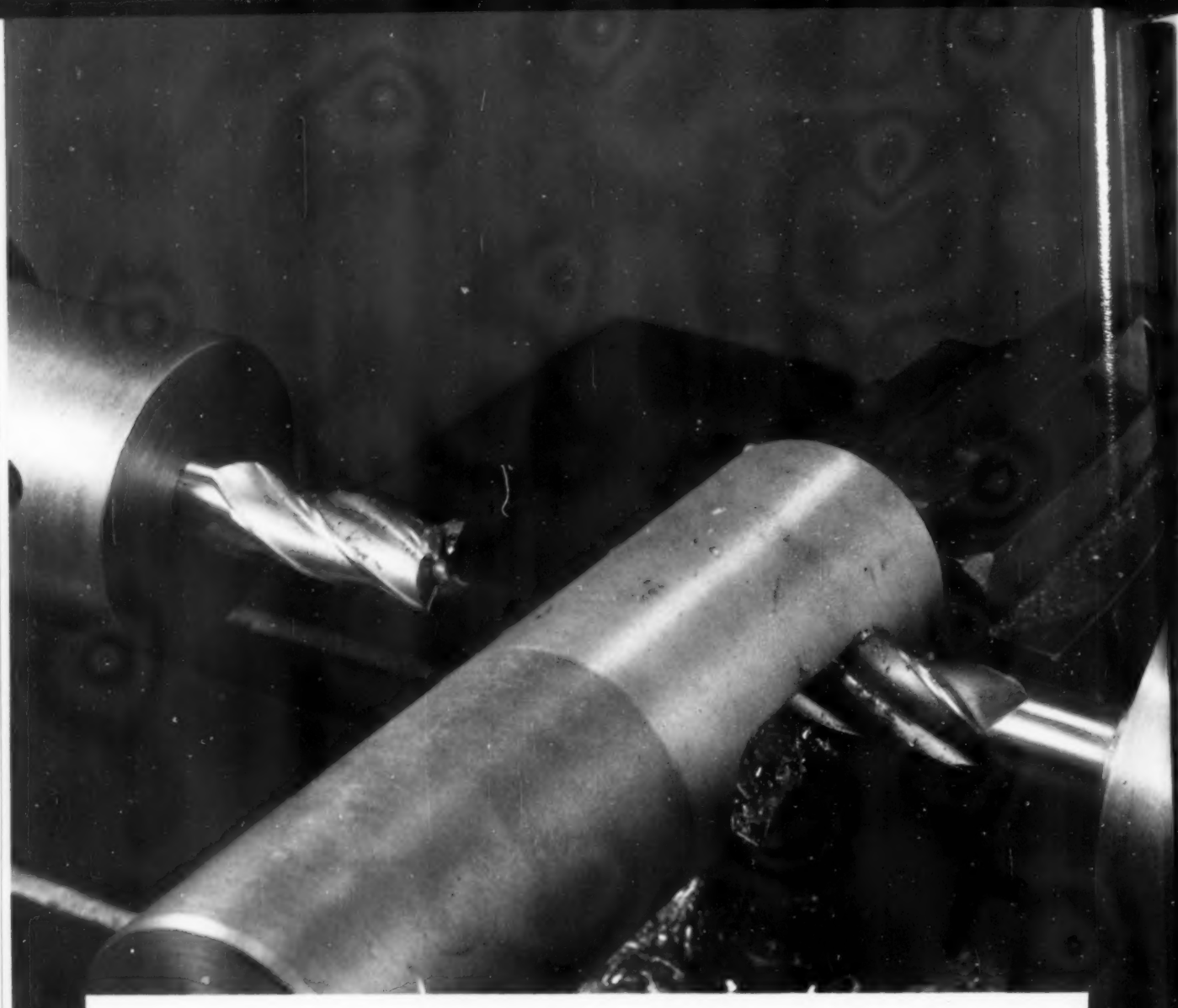
Here's a tough threading job that could be done only with an "Acorn" Die easily. The compact holder and protruding die lands permit entering the counter bored hole and cutting threads right down to the bottom.

Only a holder body, a cap and a one piece die! Put them together and you have a high speed production tool that is really rugged, accurate and dependable.

Cutting sizes #0-80 to 1½″-12.″ Holders for many types of machines.

GREENFIELD TAP AND DIE CORPORATION

GREENFIELD, MASS.



1 OR 1000 PIECES?

Few tools are called on to do the variety of jobs or to stand the punishment often expected of End Mills.

But, whether yours is a production job demanding precision with ruggedness, or just a machine shop job, GTD-AMPCO End Mills are for you.

The precision finish of shanks, uniformity of cutting teeth, exactness of size, combine to give you a rugged End Mill that is smooth and accurate in operation.

AMPCO TWIST DRILL DIVISION

GREENFIELD TAP AND DIE CORPORATION

GREENFIELD, MASS.

Efficient Stripping of Rejected Painted Parts

When the volume of painting rejects slows down your rate of production—as may occur in the manufacture of rigorously-inspected defense equipment—it is time to plan an efficient method for stripping the faulty coatings.

The rejected parts represent a considerable investment in the cost of metal and the cost of fabrication. To hide 5% of your total production in a corner is like hiding 5% of your working capital in a sock. The quicker you reclaim those rejects and push them through as accepted parts, the better profit you make on your contract.

Sometimes the time element dictates more efficient stripping. Suppose that a sub-contractor undertakes to produce 100,000 parts in 20 days. Suppose also that he averages 5% rejects and that he lets them pile up until he has 5,000 to strip and re-process on the 20th day.

On that day he discovers with sorrow that it is a lot harder to strip and repaint 5,000 rejected parts than it was to paint his regular daily quota of 5,000 new parts. He misses his deadline and suffers embarrassment that could have been avoided by stripping 250 rejects each day for 20 days instead of 5,000 in one day.

Furthermore, it usually is much easier to strip the parts on the day they are rejected. Even though the parts were thoroughly baked in the ovens, it is still true that the longer the paint ages on the metal the harder it is to remove by any method of stripping.

Another point is that the easy method of dumping the rejects into an out-of-the-way tank for overnight soaking frequently is not the best way to strip the paint. Some paints cannot be removed by immersion in any one stripper, be it alkaline or acid or solvent. Yet many such paints respond quite readily to the right combination of two of these strippers.

The technique of rinsing is also important. Some paints yield only to a hot alkaline stripper followed by a hot rinse. Sometimes a cold rinse following a hot immersion seems to provide a shock that removes the paint with great speed.

The economy of finding the best stripping method is so great that it merits careful planning. It may also require the advice of a man who has had plenty of experience with all types of stripping operations. Such a man is the Oakite Technical Service Representative in your city.

The Oakite Representative has a broad array of stripping materials at his command:

- Oakite Stripper, Oakite Stripper M-3, Oakite Stripper R-6, Oakite Composition No. 45 and Oakite Composition No. 60 are alkaline materials that work with great speed and efficiency, whether used for reclaiming rejects from the painting line or for stripping conveyor chains, racks and hooks. These materials also are excellent for "killing" the oversprayed paint in water-wash booths.
- Oakite Test X is another alkaline material capable of removing many types of paint.
- Oakite Composition No. 17 (solvent) and Oakite Composition No. 64 (alkaline) are especially designed for safe stripping of zinc chromate primer from aluminum.
- Oakite Composition No. 15, Oakite Composition No. 15A, Oakite Composition No. 18 and Oakite Composition No. 56 are solvent strippers of great effectiveness, particularly on the newer types of synthetic enamels.
- Oakite Composition No. 57 is a viscous solvent stripper that has special value for its ability to adhere to vertical and inverted surfaces.
- Oakite Compound No. 33 is an acidic material that simultaneously removes oil and rust in addition to stripping certain types of organic finishes.

For more information on this subject, phone your local Oakite Technical Service Representative or mail the coupon at the right.

Advertisement

DO REJECTS SLOW UP YOUR PRODUCTION LINE?

OAKITE PAINT STRIPPERS MAY HELP YOU BREAK THE BOTTLE'S NECK

When the volume of painting rejects slows down your rate of production—you may need one of the stripping materials described in Oakite's free booklet "How to STRIP PAINT." This compact illustrated booklet answers many questions that will help you work out better stripping procedures. As a metal processor you will be particularly interested in:

- **What's the best way to strip paint from metal parts too large to be soaked in tanks?** *See page 3.*
- **What is the cheapest way to strip metal parts in large volume?** *See page 9.*
- **What are the best ways to prepare stripped surfaces for repainting?** *See page 11.*
- **What strippers are best for removing oil-base paints?... Synthetic enamels, alkali-resistant plastics or resin-based paints?... Japans, wrinkle finishes, nitrocellulose lacquers, alkyds, phenolics and ureas?** *See page 12.*

FREE **For a copy of "*How to STRIP PAINT*" and for advice on your particular paint-stripping problem, just send us the coupon.**

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SPECIALIZED INDUSTRIAL CLEANING
OAKITE
MATERIALS · METHODS · SERVICE

OAKITE PRODUCTS, INC.
58 Rector Street, New York 6, N. Y.

Send me a FREE copy of your booklet "*How to STRIP PAINT.*" Also, tell me about your methods for removing the following organic finishes:

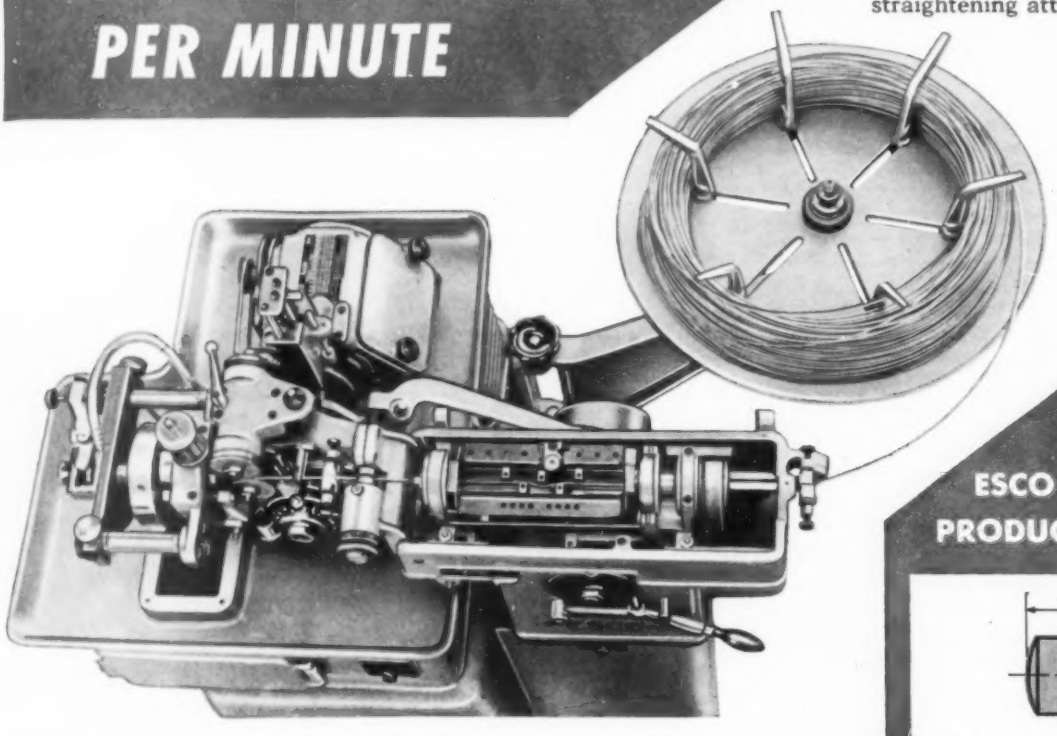
Name

Company

Address

GET UP TO 100 SMALL PRECISION PIECES PER MINUTE

Below: ESCO ROTOMATIC DS 1 with optional wire-straightening attachment

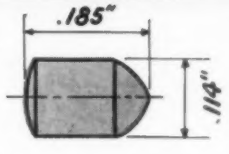


PARTS UP TO 5/32" DIA. X 1" LONG MACHINED AS CLOSE AS ± .00025" FROM COILS OR BARS

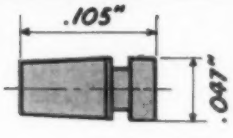
A Swiss automatic form-turning and cut-off machine with optional wire-straightening attachment—you get high-speed production from coils or bars of any length. Coil-feeding speeds and economizes your operation by eliminating bar ends and bar loading time. Machining is done by two cutting tools mounted in a cam controlled tool head. The tool head rotates around material which is fed, guided, and clamped by a collet and a guide bushing. Machined parts are smooth, straight and *entirely burr-free* when they are delivered to the tray *separate from the chips.*

Get more information today about this machine and see how it can boost your production and cut your costs.

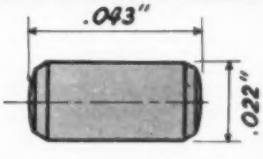
TYPICAL ESCO ROTOMATIC PRODUCTION RATES



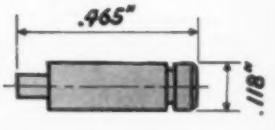
100/min.—brass



63/min.—nickel-silver



50/min.—nickel



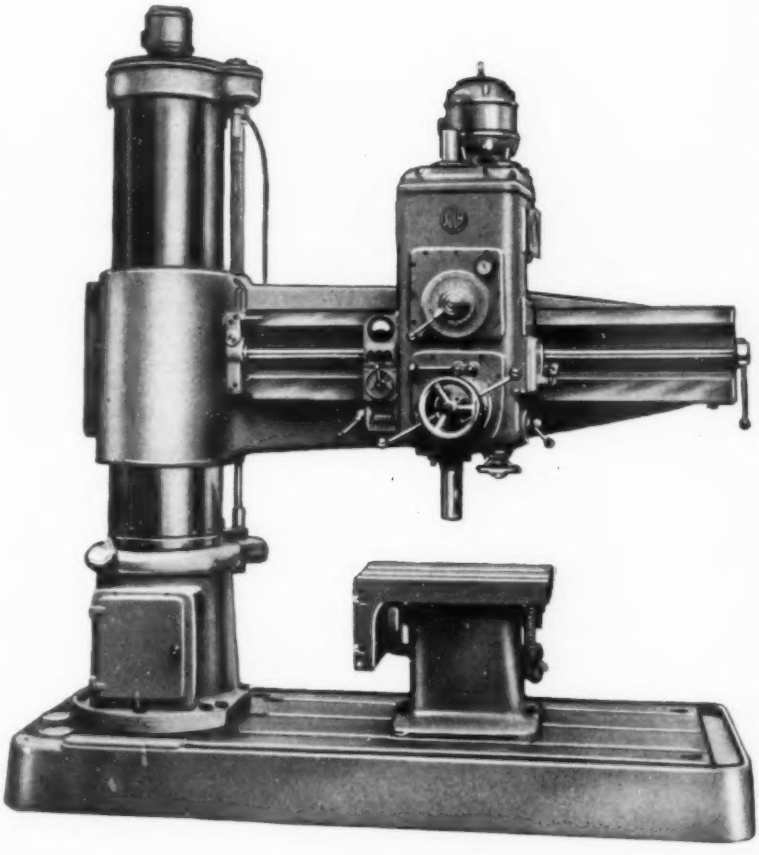
10/min.—mild steel

COSA CORPORATION
405 Lexington Ave., New York 17

Your source for all Precision Machine Tools—from Small Bench Lathes to Large Boring Mills

IN DETROIT AREA contact DETROIT-COSA CORPORATION, 16923 James Couzens Highway, Detroit 35, Mich.

KOLB RADIAL DRILLS FOR LIGHT · MEDIUM · HEAVY DUTY



For greater efficiency, 36 speeds and 12 feeds can be pre-selected on this HKH Kolb Radial equipped with electro-hydraulic pre-selectors.

FOR ACCURATE PRODUCTION

- Heavy bases, columns and arms —Rigidly constructed
- Column diameters from 7½" to 35"
- Flanged motor mounted on top of spindle head
- Hardened and ground gears
- Hardened and ground spline shafts rotating on ball bearings

FOR SPEEDIER PRODUCTION

- Selector device for pre-setting speeds and feeds
- Rigid locking of column and spindle head by electro-hydraulic clamping system (automatically or by hand)
- Push button controls
- Automatic depth release

FOR YOUR PRODUCTION

- Maximum drilling capacities Cast Iron—8" dia. Steel—6" dia.
- Maximum drill radii—27" to 180"
- Spindle speeds—12, 24 or 36—from 30 to 3000 R.P.M.
- Feeds—6, 9, 12 or 18—from .0012" to .1181" per rev.

THERE IS A KOLB RADIAL FOR YOUR DRILLING JOB
LET COSA QUOTE ON YOUR SPECIFIC NEEDS

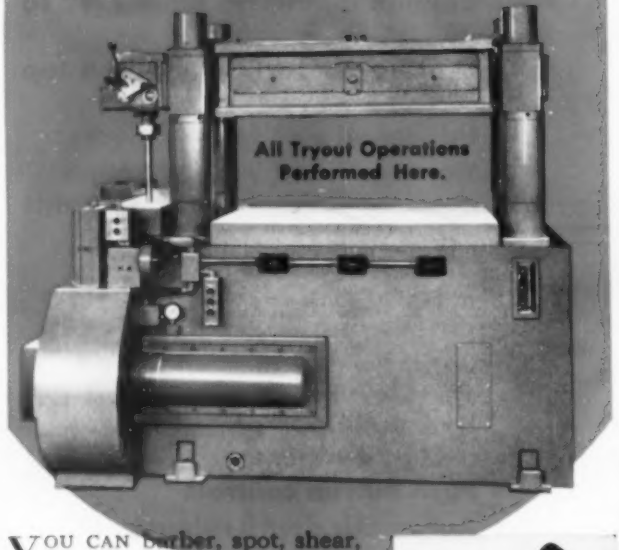
COSA CORPORATION
405 Lexington Ave., New York 17

Your source for all Precision Machine Tools— from Small Bench Lathes to Large Boring Mills

IN DETROIT AREA contact DETROIT-COSA CORPORATION, 16923 James Couzens Highway, Detroit 35, Mich.

NEW ALPHA 100 TON DIE TRYOUT PRESS

Saves Skilled Labor Hours



YOU CAN barber, spot, shear, fit and finish both die and punch WITHOUT REMOVING the DIE. "Tryouts" take less time because the press is open on all four sides, giving easy access to the die and punch. The head can be quickly released and rotated to any point up to 240°. This new press is compact, being 82" high and occupying only 75" x 84" of floor space. The rugged construction of the Alpha 100-ton die tryout press assures years of trouble-free service.

The top die in position for altering.

It's easy to work on the bottom die.

Send today for your free folder. It gives all the details about this remarkable press.

ALPHA TOOL WORKS
9281 Freeland Ave.
Detroit 28, Mich.

USE READER SERVICE CARD; INDICATE A-6-174-1

There's a Walker Magnetic Chuck for Every Known Application . . .

For sixty years, Walker has specialized in the designing and production of magnetic holding devices. Today, Walker produces a complete line of magnetic chucks and designs special chucks to meet unusual holding problems.

●

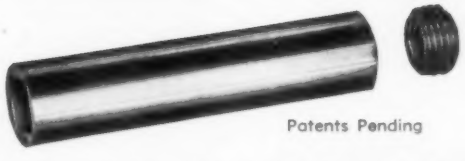
Standard Electro and Permanent Magnetic Chucks . . . Vacuum Chucks . . . Special Applications for various holding problems . . . Demagnetizers . . . Magnetic clutches.

Original Designers and Builders of Magnetic Chucks

O. S. WALKER CO. Inc.
WORCESTER 6, MASSACHUSETTS

USE READER SERVICE CARD; INDICATE A-6-174-2

How SQUARE HOLED SLEEVES SPEED UP TOOL-MAKING!



Patents Pending

One of the most difficult problems in tool making can be solved easily and quickly with Sturdy Square Holed Sleeves. The perfection of broached square holes can be had in boring bars, milling cutters and many other applications at a small fraction of the cost of imperfect hand-made square holes. The Sturdy Square Holed Sleeve consists of a round sleeve with a perfectly square hole broached through the center. This hole is tapped at one end to receive a back-up screw which is furnished with the Sleeve. The Sleeve can be sweated or pressed into a drilled and reamed hole to make a perfectly square accurate hole in a very few minutes.

The Sturdy Square Holed Sleeve will save you many hours and many dollars in the making of boring bars, tool holders and other tools requiring square holes.

SLEEVES MADE IN FOLLOWING SIZES:
3/16, ¼, 5/16, ⅜, 7/16, ½, ⅝, ¾, 1"

●

STURDY BROACHING SERVICE
23520 TELEGRAPH RD., DETROIT 19, MICH.

Write for Literature

USE READER SERVICE CARD; INDICATE A-6-174-3

ACCO products

CAMPBELL Abrasive Cutters

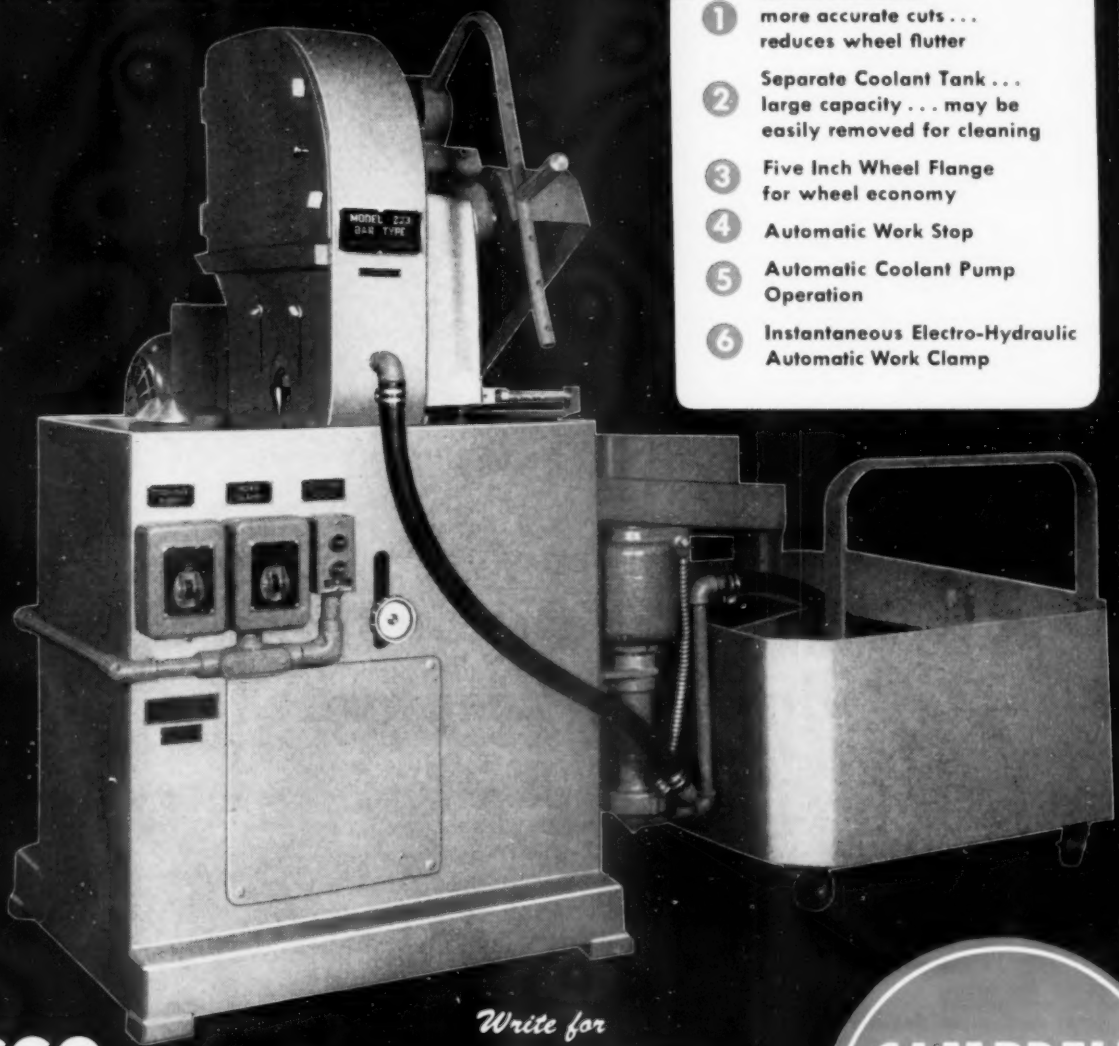
New... Low Cost

No. 223 Wet Abrasive Cutting Machine

Fast, clean, close tolerance cuts of hardest alloys and all other metals. Won't work-harden material.

FEATURES

1. Wheel Guides for more accurate cuts... reduces wheel flutter
2. Separate Coolant Tank... large capacity... may be easily removed for cleaning
3. Five Inch Wheel Flange for wheel economy
4. Automatic Work Stop
5. Automatic Coolant Pump Operation
6. Instantaneous Electro-Hydraulic Automatic Work Clamp



Write for "Principles of Abrasive Cutting"

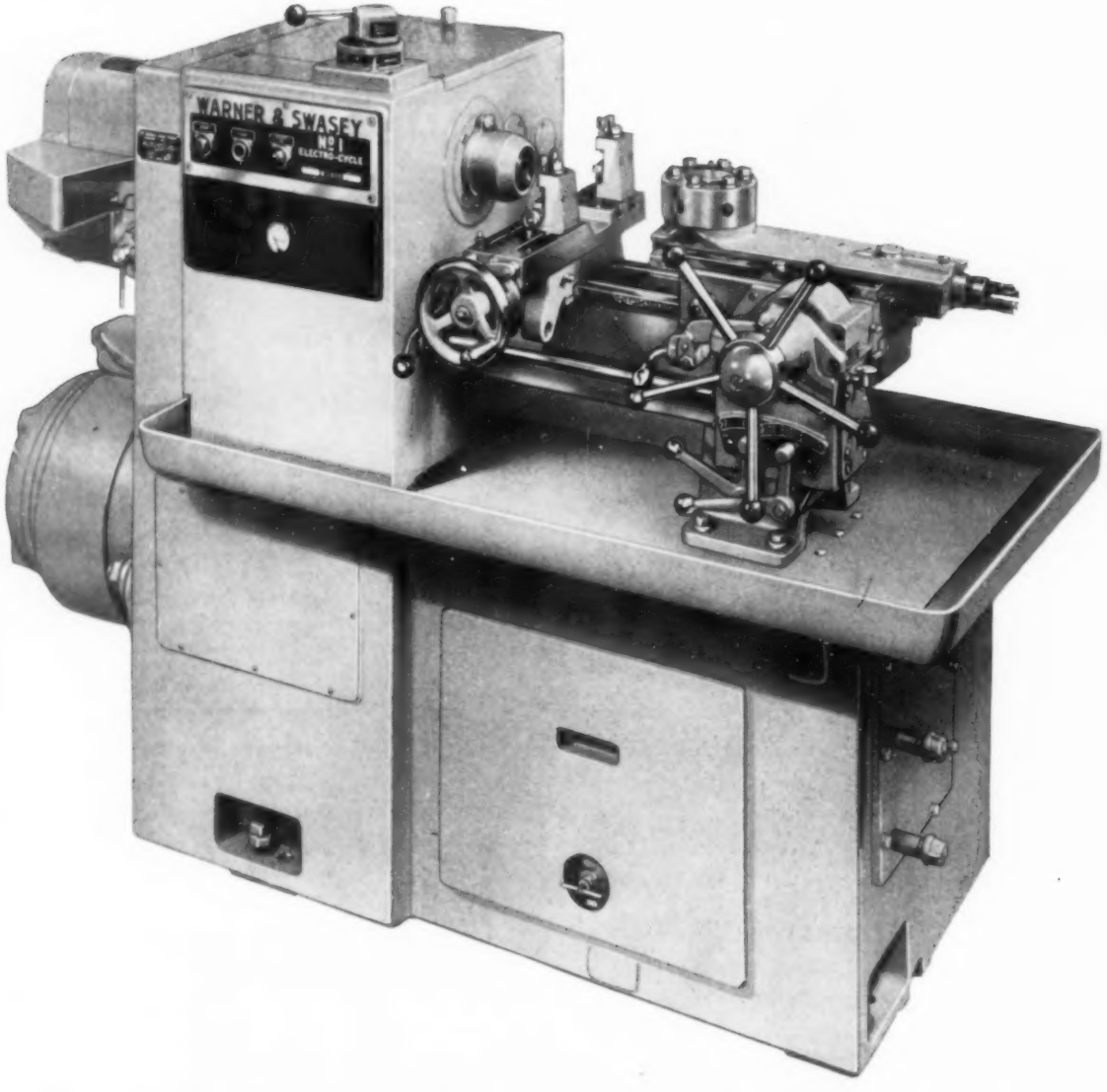
ACCO

TRADE MARK

CAMPBELL MACHINE DIVISION
AMERICAN CHAIN & CABLE

945 Connecticut Ave., Bridgeport 2, Conn.

CAMPBELL
Abrasive Cutters and Nibblers



New Warner & Swasey Turret Lathe wins fast acceptance!

SINCE its introduction in 1950, the Warner & Swasey No. 1 E-C has lived up to the reputation for accuracy and dependability already set by its "big brothers" in the Warner & Swasey line. But, let the users themselves tell you how this new 5/8" capacity machine is performing for them:

". . . a great deal more flexible than previous machines of its size."

". . . more rigid."

". . . power feed to turret a decided advantage."

". . . delighted with its accuracy and speed range."

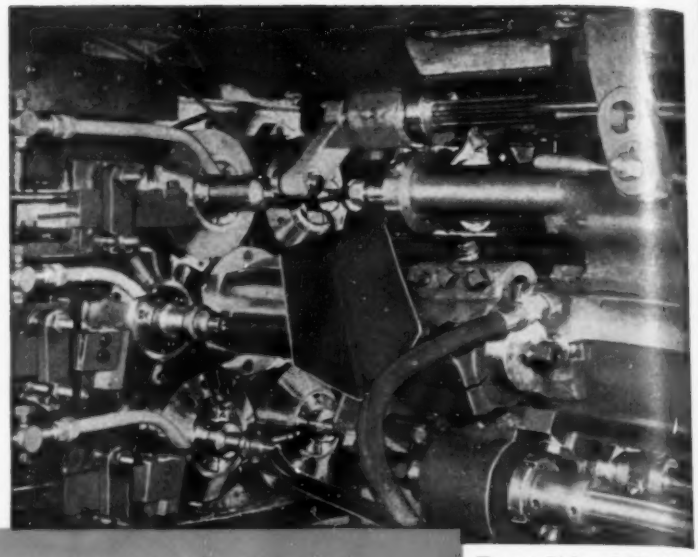
". . . more efficient on stainless steel."

". . . better range of speeds for turning and threading."

And the reports continue to come in from all types of metalworking plants across the country. Such plants as Dumore Company of Racine, Allmetal Screw Products of New York City, Bahnson Company of Winston-Salem, Wisconsin Motor Corp. of Milwaukee, Kearfott Manufacturing of Newark and many others tell us the 1 E-C is out-performing any small capacity turret lathe they've ever had in their plants. You'll find it profitable to investigate the Warner & Swasey No. 1 E-C Turret Lathe, so have your Warner & Swasey Field Engineer show you how it can improve *your* small diameter bar operations.

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS WITH WARNER & SWASEY MACHINE TOOLS, TEXTILE MACHINERY, CONSTRUCTION MACHINERY



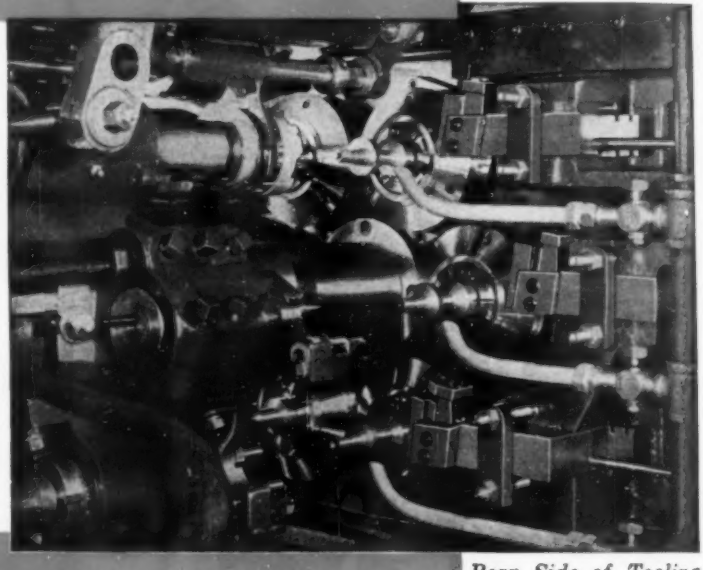
Front Side of Tooling Area 1-5/8-SIX

THE FACILITY BEHIND THE NEWS

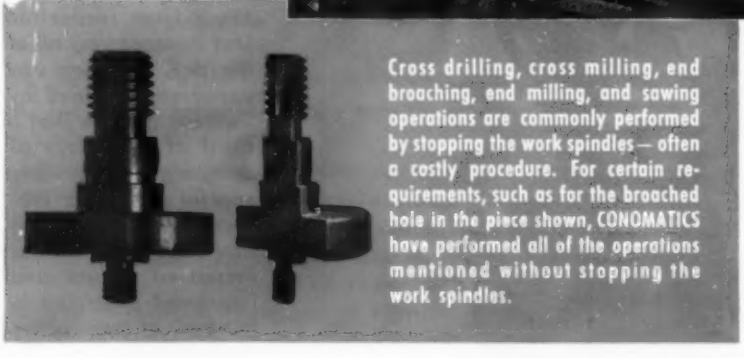
Case histories have appeal, whether they're about someone's time being bettered at a lathe or at an altar. Success likes success, and "misery likes company."

An "automatic's" case history is just an *end* of a *means* of machining facility. If you procure the right facilities, good case histories will result in *your* plant.

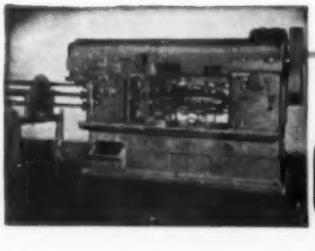
When selecting the best multi-spindle automatic facility for *your* needs, you will want to compare *all brands.* But you should have *full* information for a thorough comparison. You can have it on CONOMATICS.



Rear Side of Tooling Area 1-5/8-SIX



Cross drilling, cross milling, end broaching, end milling, and sawing operations are commonly performed by stopping the work spindles—often a costly procedure. For certain requirements, such as for the broached hole in the piece shown, CONOMATICS have performed all of the operations mentioned without stopping the work spindles.



A Comparison of ALL Automatics is in favor of Cone

Conomatic } CONE AUTOMATIC MACHINE COMPANY, INC. WINDSOR, VT., U.S.A.

This camera helped Parker strike a hotter spark

Parker Pen Company engineers like a hot spark to light the compressed gas in their new Flaminaire lighter.

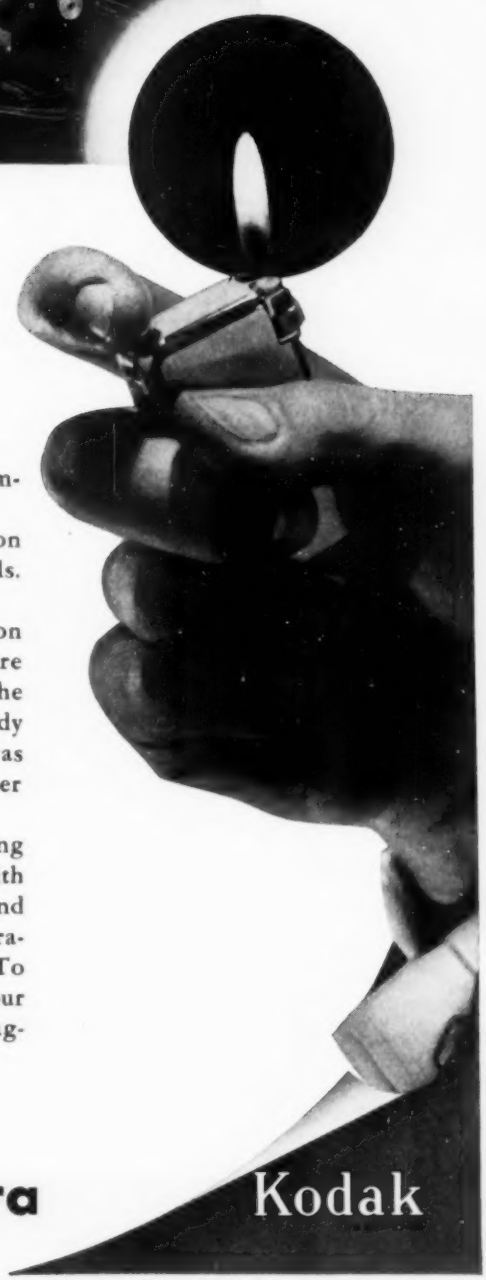
Getting a hotter spark meant a study of the split-second action between various kinds of sparking wheels and "flint" materials. Parker did the study with their Kodak High Speed Camera.

This versatile instrument takes up to 3200 pictures a second on 16mm film—slows action as much as 200 times when the films are projected at normal speed on a standard projector. By analyzing the films, Parker engineers and research physicists were able to study spark particle propulsion and ignition phenomena. The result was the design and development of a more efficient and durable lighter mechanism.

If you have a product design or performance problem involving high speed action, high speed movies may show you the answer with less time-consuming cut-and-try experimentation. And, you'll find the Kodak High Speed Camera has a speed range and ease of operation that make it particularly suited to industrial applications. To find out how it has worked for others, send for your copy of our informative booklet. Or, write for details on a sound movie, "Magnifying Time."

Industrial Photographic Division
EASTMAN KODAK COMPANY, Rochester 4, N. Y.

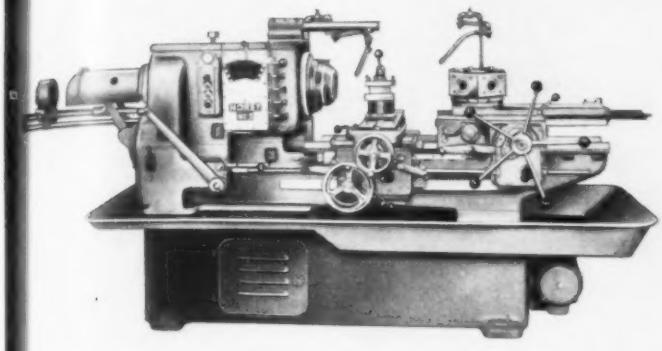
the Kodak *HIGH SPEED* Camera



ORIGINAL DESIGNS THAT SET THE PACE

MOREY

ORIGINAL DESIGNS THAT SET THE PACE FOR TOMORROW'S MACHINE TOOLS

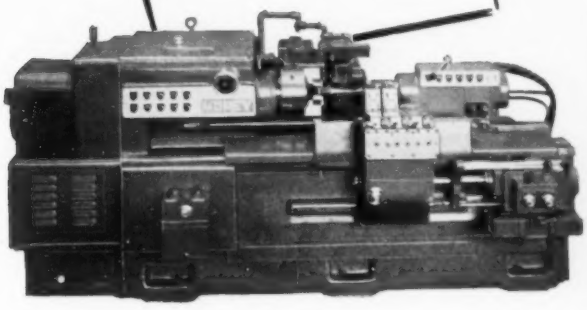


TURRET LATHES

Morey has four basic models to meet your specific requirements. Many lathes are in 20-hour daily operation, using motors up to 200 HP and at spindle speeds of 2700 RPM. Metal is removed so quickly a conveyor is available for removal of chips!

No. 2	1" x 6"	No. 4	2" x 12"
No. 3	1½" x 10"	No. 5	2½" x 14"

Manufacturing Lathes



Over 350 of these outstanding lathes are now in operation in the production of shells and similar parts! Finish turning is accomplished with speed and economy . . . with precision results of superior quality.

Built to take Advantage of Tungsten Carbide Tools

Heavy Duty Vertical "Aeroframe" Profiler and Milling Machine

The new 40M Milling Machine is specially designed for milling and profiling difficult and irregular shapes with ease. Inspection of the machine in operation will disclose many uses in your milling problems!

The Morey 12M Double Spindle High Speed Vertical Profiler and Milling Machine gives rapid, economical duplication of small parts that require accurate interchangeability.

14" VERTICAL SHAPER

Rigidly built and heavily ribbed, it is easily and quickly set up, flexible in operation, and turns out precision work at a minimum cost! Particularly suitable for toolroom and production work, this machine will do the most difficult jobs with ease.

All these machines available for prompt delivery . . . Send for complete 1953 catalog, now ready!

MOREY ...for machine tools!

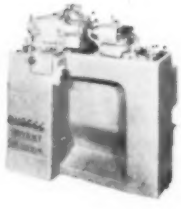
MOREY MACHINERY CO., INC.

Manufacturers • Merchants • Distributors

410 BROOME STREET • NEW YORK 13, N. Y.

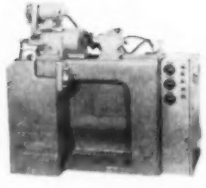
TELEPHONE: CANAL 6-7400

bryant
internal grinding



no. 1309-W

Finishes 2 bores and a taper straight and concentric. 2 wheelheads are used on this semi-automatic. Max. traverse stroke, 6". Max. grinding length, 3½".

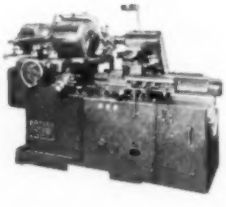


no. 1109

For high production of small bores where accuracy of size and finish are required. Max. traverse stroke, 6". Max. grinding length, 3½".

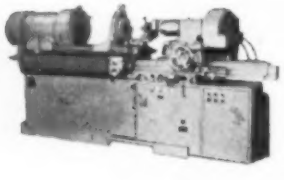
no. 2209

For precision and high production grinding of ball bearing races, gears, rolls, bushings, etc. Max. traverse stroke, 6". Max. grinding length, ¾".



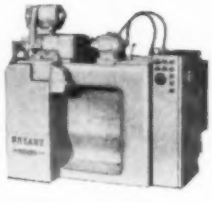
no. 1116

A general purpose hole grinder for tool room, small shop, or general production. Maximum traverse stroke, 20". Maximum grinding length, 8".



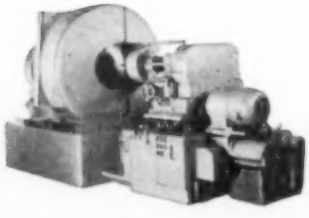
no. 1416

Specially designed for grinding bores in long work, such as machine tool spindles. Maximum traverse stroke, 20". Maximum grinding length, 8".



no. 1209

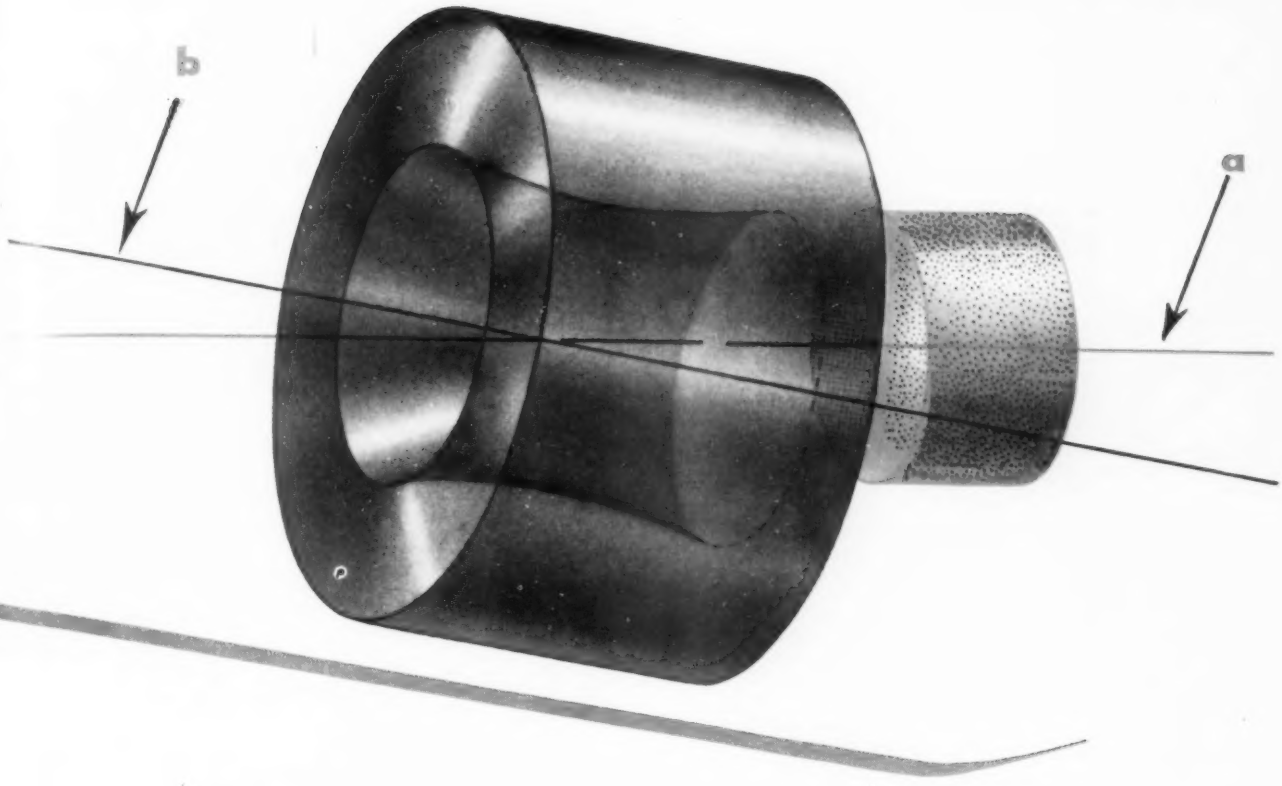
A fully automatic, high production machine for small and medium bore grinding. Max. traverse stroke, 6". Max. grinding length, 3".



no. 1460

For production or single piece hole grinding on parts up to 60" diameter. Max. traverse stroke, 21". Max. grinding length, 16".

"Alignment for Better Internal Grinding", a new, sound color moving picture is available for free showing to engineering groups. Write for descriptive booking form.



BELL mouth holes are a common internal grinding error. General available information advises simply turning the workhead or changing the length of traverse to correct this error, to generate a straight hole. In the case illustrated above, where bell mouth exists on both ends of the hole, either turning the workhead or changing the length of stroke will improve the shape of the hole but will not correct the error. In the illustration, the work axis "b" is tipped out of alignment with wheel and wheel path axis "a". When the wheel, moving on axis "a", traverses the front of the hole, it grinds above the work center line and the front of the hole will be oversize. As the wheel traverses the center of the hole, the hole will be smaller. As the wheel traverses the back of the hole, it grinds below the center line and the hole will again be oversize. While the wheel contact may be a full line, it will not be parallel to the axis of the work.

The only possible remedy is to correct the alignment of the workhead axis "b" so that it will be parallel with the wheel and wheel path axis "a". Wheel wear will be uniform but, most important, the geometry of the hole will be correct.

Bryant internal grinders are engineered to permit adjustment which will bring the workhead into proper alignment.

Bryant Chucking Grinder Company

Springfield, Vermont, U. S. A.

Internal grinders • Internal & External thread gages

RADIUS FORMING TOOLS

"TRU-LINE" PROFILE DRESSING TOOLS

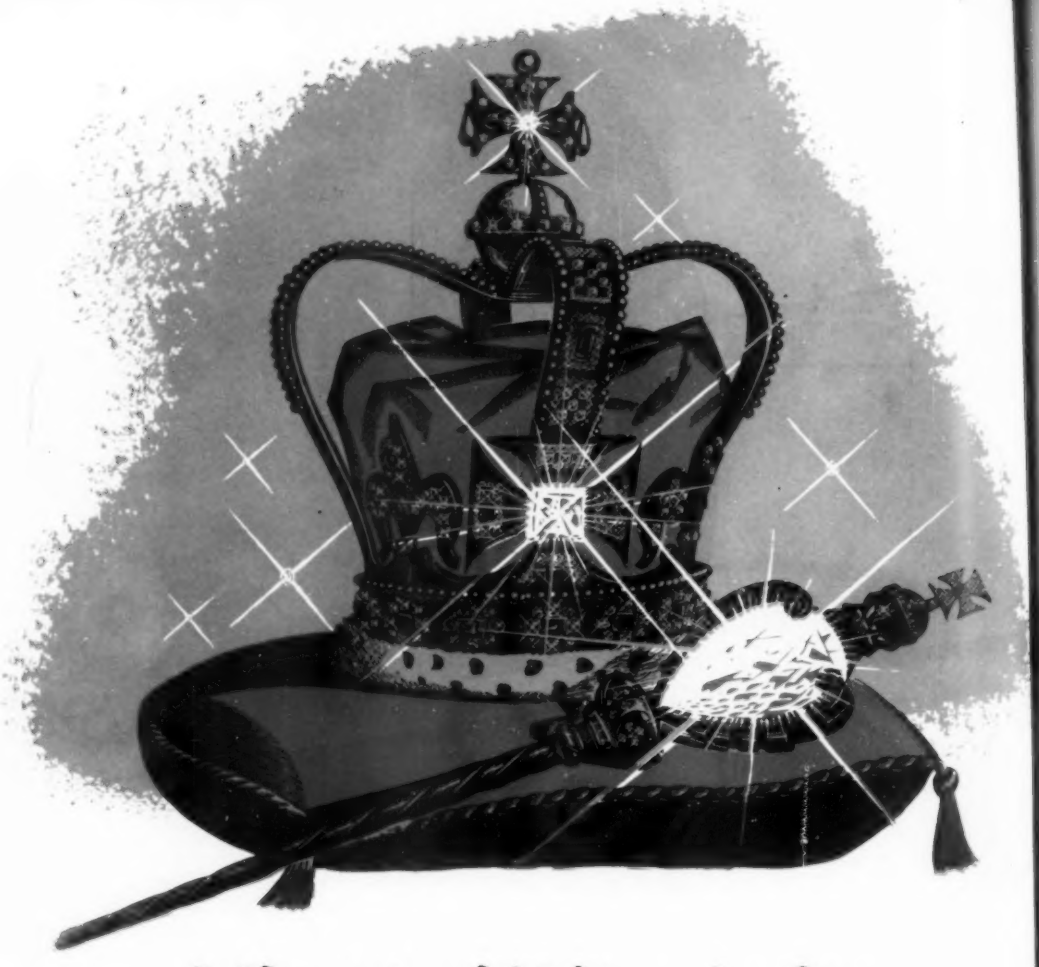
IMPREGNATED DRESSING TOOLS

STANDARD DRESSING TOOLS

"TRU-THREAD" THREAD DRESSING TOOLS

DIAMOND GRIT TOOLS FOR THREAD DRESSING

INDUSTRIAL DIAMONDS



A Mountain of Light, and a Star

When the royal crown is placed upon a British monarch's head, the soft lights of Westminster Abbey dance upon some of the most beautiful jewels in existence, including two of the world's greatest diamonds—the Koh-i-noor and the Great Star of Africa.

The Koh-i-noor, or "Mountain of Light," was found four thousand years ago in the legendary diamond fields of the King of Golconda. War, conquest, torture, theft, assassination and barter brought it to princes, moguls, shahs and rajahs, and brought tragedy, too, so the legend says, except when it was worn by a woman. Originally it weighed 800 carats, but cutting has reduced it to 106½ and greatly increased its beauty. It adorns the front of the Queen's crown.

The Great Star of Africa, set into the top of the royal scepter, weighs 516½ carats and is the largest cut diamond in the world. The original stone weighed 3,025 carats (about a pound and a half) and although it was the largest diamond ever found, was, obviously, but part of a much larger stone, still undiscovered.

The Great Star was found in 1905, just five years before this company was founded, and came from Premier Mine No. 2 in South Africa, which produces many of the fine industrial diamonds which we have imported for our customers during our 43 years. Our field engineers are at your service.

WHEEL TRUEING TOOL COMPANY

14-3200 West Davison Avenue • Detroit 6, Michigan

ESTABLISHED 1910

Offices in Principal U. S. Cities—Agents Throughout the World

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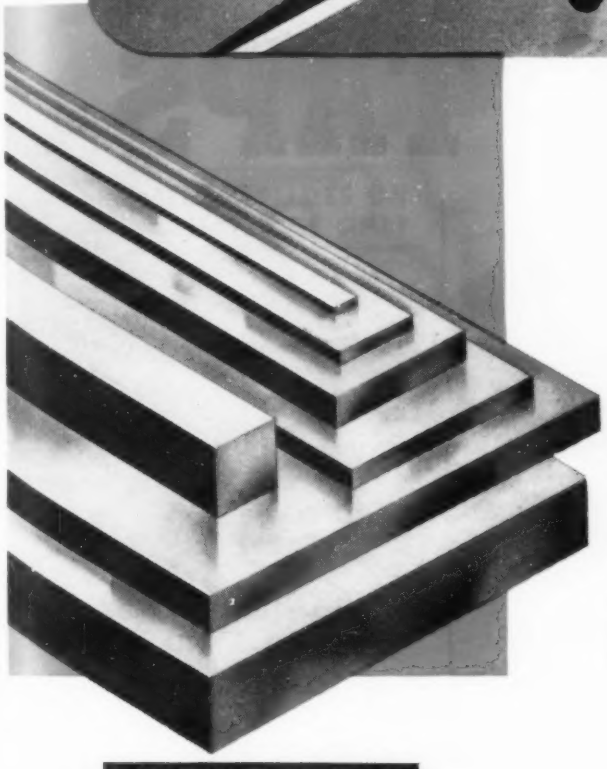
33 West Street, Bloomfield, N. J.

WHEEL TRUEING TOOL COMPANY OF CANADA, LTD.
575 Langlois Ave., Windsor, Ont.



SIMONDS

FLAT GROUND

DIE STEEL

The Ready-to-Use Steel of 1001 Uses!

Simonds offers you a choice of OIL or AIR Hardening DIE STEEL, whichever is best suited to your requirements. Both types are made from Simonds own steel, are precision ground to a thickness limit of plus or minus .001″ and have an extra smooth surface finish of 25 to 35 micro inches. Edges and ends are square and parallel, with all scale, decarburation and surface defects removed. All sizes come individually packaged with heat treating instructions.

SIMONDS AIR HARDENING DIE STEEL

(non-deforming 5% Chrome Type) is spherodize annealed for good machinability and uniform hardenability. Its wide hardening range (1700° to 1800° F.) makes it practically foolproof in heat-treating. Stock sizes run from ½″ to 2″ thick and 2″ to 10″ wide in 36″ lengths.

SIMONDS OIL HARDENING DIE STEEL

(non-deforming Molybdenum Type) is uniformly annealed for easy machining and uniform hardening. Due to its wide hardening range (1450° to 1540°) good results are assured with even the simplest heat treating equipment. Stock sizes are available from ¼″ to 3″ thick and ⅜″ to 14″ wide in 18″ lengths. The heavier sizes also come in 36″ lengths.

Try a bar on your next job. Your Simonds Distributor carries many sizes of both types in stock — call him right now.

SIMONDS SAW AND STEEL CO.

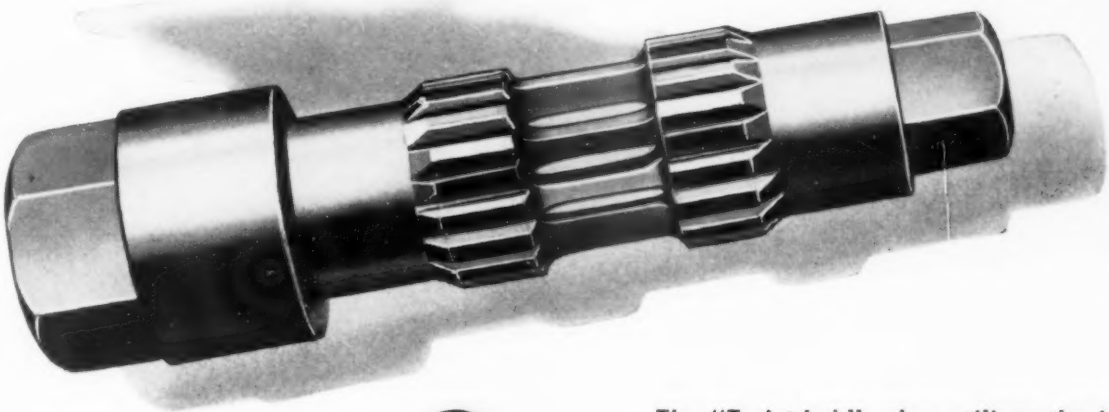
FITCHBURG, MASS.

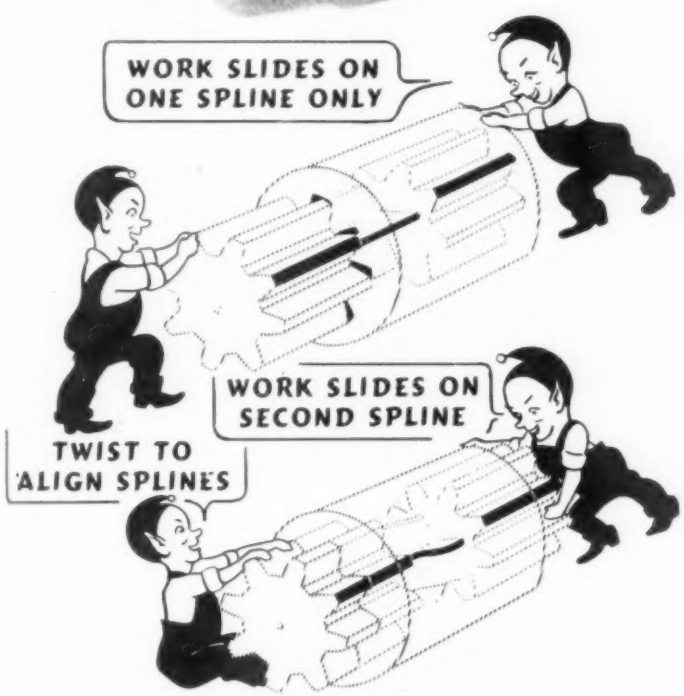
Factory Branches in Boston, Chicago, San Francisco and Portland, Oregon.
Canadian Factory in Montreal, Que.

Simonds Divisions: Simonds Steel Mill, Lockport, N. Y., Simonds Abrasive Co., Phila., Pa. and Arvida, Que., Canada

A NEW TWIST IN ARBORS

The Woodworth TWIST LOK *principle for splines*





The "Twist-Lok" arbor utilizes the inherent strength of tough, durable spring steel. There are no moving parts to wear. The Twist-Lok principle insures —

Accuracy you can trust

In a relaxed state, two spline surfaces are finished machined out-of-alignment. A part placed on the arbor goes on the first locating surface easily. With a twisting motion (wrench or air-operated) the reeds are "wound" permitting the spline surfaces to align, and allowing the part to be loaded. The twisting action is released and the part is chucked by the unwinding of the reeds.

One chucking surface is firmly against one wall of the part spline, the other chucking surface is firmly against the opposite wall of the part spline.

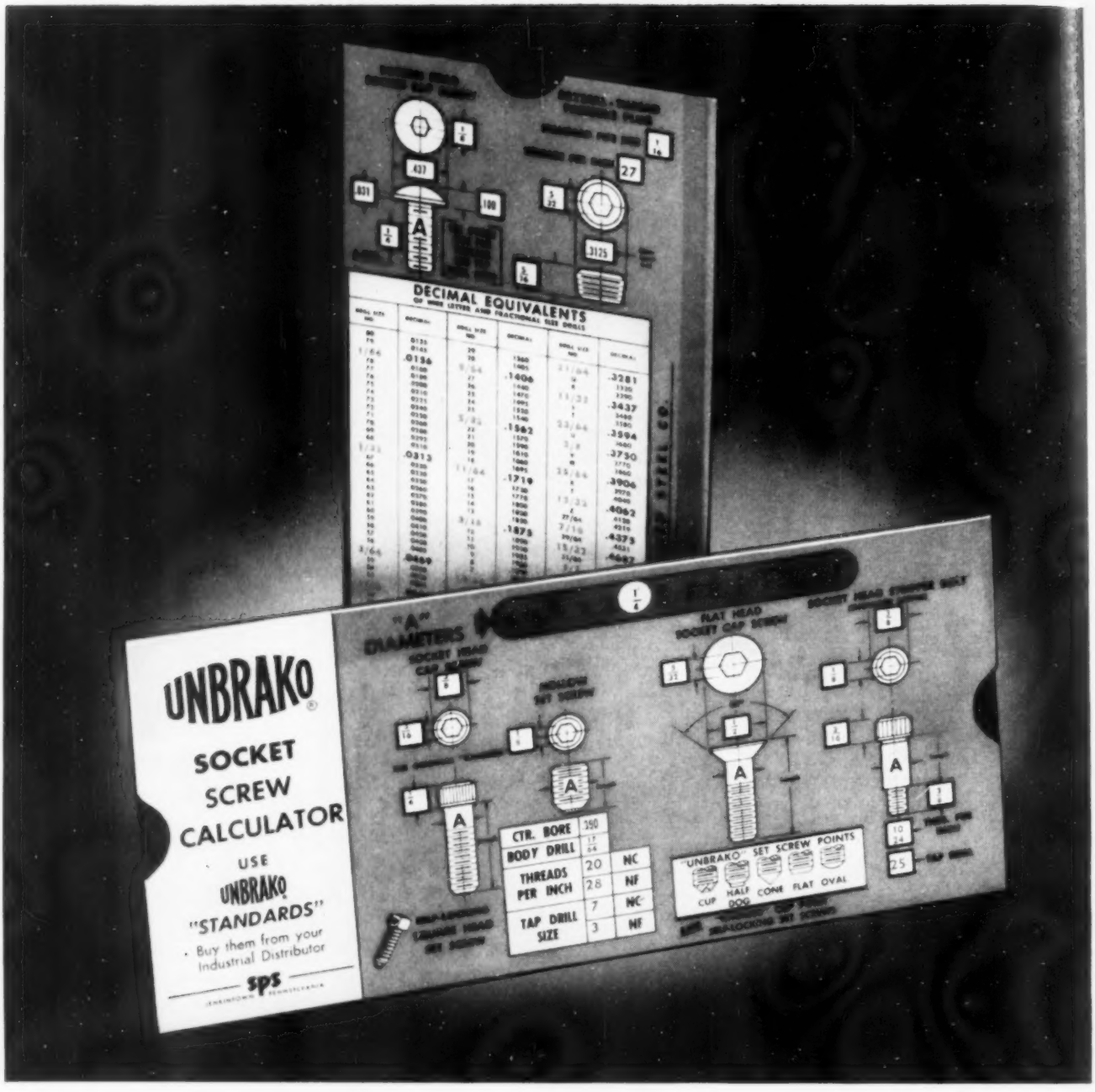
Your spline part is chucked securely and on center within a fraction of the concentricity tolerance.

The "Twist-Lok" arbor is additional proof that Woodworth Chucking Specialists have the answer to your chucking problem.

WOODWORTH

N. A. WOODWORTH CO., 1300 EAST NINE MILE ROAD · DETROIT 20, MICHIGAN

PRECISION GAGES · DIAPHRAGM CHUCKS AND ARBORS · CONE-LOK JIGS



Our New UNBRAKO Socket Screw Calculator—YOURS FOR THE ASKING

This handy pocket-sized slide-rule type socket screw calculator gives diameters, lengths, socket dimensions, threads and drill sizes—in fact, everything you want to know when using UNBRAKO socket screw products. And it's free.

Ask your UNBRAKO distributor, or write to SPS, Jenkintown 37, Pa.

Standard UNBRAKOS *sold by leading industrial distributors everywhere.*

UNBRAKO®

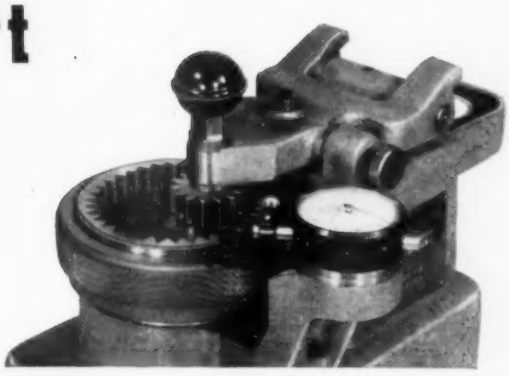
SOCKET SCREW DIVISION

Our Fiftieth Year : A START FOR THE FUTURE

SPS
JENKINTOWN PENNSYLVANIA

Self-Locking Set Screws • Flat Head Cap Screws • Shoulder Screws • Knurled Head Cap Screws • Dowel Pins • Button Head Socket Screws

You don't have to FIGHT these Gear Rolling Fixtures!



Did you have difficulty mounting the gear due to the spring tension that caused your master gear to interfere when you tried to mount it? Did you have trouble getting the gear out of the fixture, especially a pot type fixture for internal gears? Was the slide action so stiff or so sloppy that you were never quite certain whether your checks were accurate or not? Was the fixture awkward to use? Did face runout on your internals make your roll check meaningless?

If you have had any of those experiences, you will "take off your hat" to the new line of Michigan Tool gear rolling fixtures. They were designed to eliminate every one of those problems that have plagued the rolling fixture operator in the past.

Ask for Bulletin 6-702 for complete specifications and information on the complete line of Michigan Tool Rolling Fixtures.

GEAR PRODUCTION HEADQUARTERS

MICHIGAN TOOL Company

from blank to finished gear

7171 E. McNICHOLS RD. • DETROIT 12, MICHIGAN, U. S. A.

COMPLETE EQUIPMENT for GEAR PRODUCTION

Cutting
Finishing
Checking

Shown here is only a part of Michigan's complete line

4 jobs better with 1 basic tool!

FORD "Quad"

HSS chatterless countersink

Ford's exclusive job-engineered flute design, precise concentricity, greater rigidity, lower cost add up to faster production, better production, more profitable production. No secondary burs. Ideal for heavy duty applications. Write for details.

FORD "standard"

chatterless countersink

Engineered by Ford for peak operating efficiency commensurate with lowest possible initial tool cost. Ford's know-how makes possible a competitively priced tool without sacrifice of performance.

FORD -- *the complete line!*

HSS ground cutters, rotary files, countersinks
CARBIDE cutters, end mills, grinding burs

Complete Details. Operating Data

All specifications plus informative operational data on more than 300 FORD rotary tools contained in new FORD Catalogue No. 207. Write for yours!

FORD regrinding service adds tool life, reduces tool costs!

M. A. FORD MFG. CO., INC.

Pioneers in rotary tools for more than 30 years

DAVENPORT 6, IOWA

USE READER SERVICE CARD; INDICATE A-6-192-1

Check YOUR SET-UP TIME!

If you'll check the time it takes to make a set-up for a tapping or reaming job with a Ziegler Tool Holder, as compared with an ordinary tool holder, you'll be amazed at the time the Ziegler saves.

This is because, with the Ziegler, the set-up doesn't have to be nearly as accurate. Just come wtihin 1/32" of center on the radius (or 1/16" on the diameter) and the Ziegler automatically compensates for the inaccuracy.

With labor costs steadily increasing, it pays to follow methods that take less time. This is why the Ziegler is used in leading shops throughout the nation.

W. M. ZIEGLER TOOL COMPANY
13574 AUBURN DETROIT 23, MICH.

WRITE FOR CATALOG

Ziegler ROLLER DRIVE FLOATING HOLDER for Taps and Reamers...

USE READER SERVICE CARD; INDICATE A-6-192-2

AIRCRAFT PARTS... LIKE THESE...

Valve Stem for Fuel Injection System, Jet Propulsion Engine. MATERIAL Stainless Steel

Ball and Race Unit for Radar Instrument. Lapped to No. 3 Micro Finish .0001 Accuracy all over. MATERIAL: Nitralloy

.. ARE PRECISION-MADE by...

FULLER

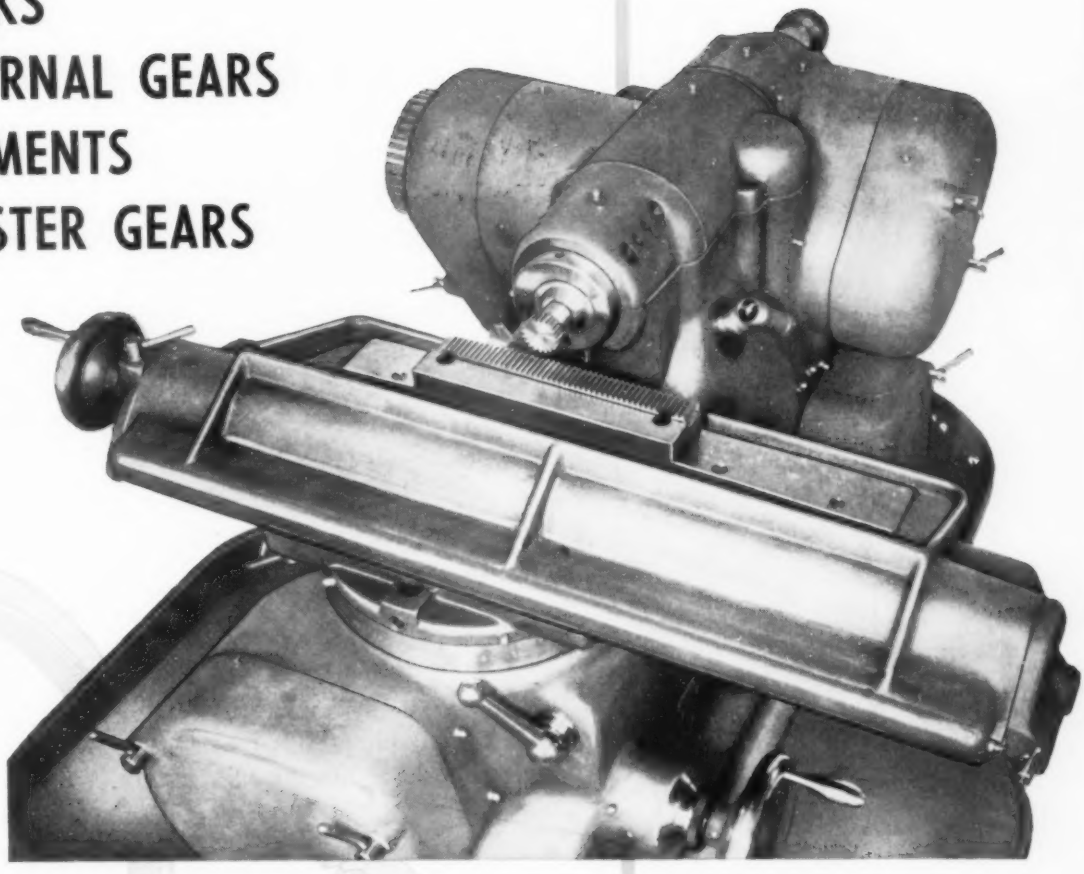
Close tolerance parts for aircraft, radar, electronics, precision instruments, etc. Screw machine, milling, boring, grinding, honing, and tapping operations, with accuracies to .00005. Fine finishes to No. 3 Micro. Heat resistant and stainless steel, Nitralloy, bronze, etc.

FULLER TOOL CO.
4000 W. ELEVEN MILE RD.
BERKLEY, MICH. LINCOLN 2-5600

USE READER SERVICE CARD; INDICATE A-6-192-3

MIKRON *fine pitch*

- RACKS
- INTERNAL GEARS
- SEGMENTS
- CLUSTER GEARS



THE precision cutter shapes as it generates tooth forms. The work meets your most exacting specifications and standards. Gear production requiring a shaping operation will be ideally performed with the MIKRON No. 134.

RACK & GEAR CUTTER No. 134—Another machine in the MIKRON line—Controlled Accuracy, High Finish, Ease of Set-Up.

WORK PIECE CAPACITY

RACKS: (Straight or Skew) to 36″ long x 1″ wide.
SEGMENTS & CLUSTERS: to 3⅛″ dia. x 1″ wide.
INTERNAL GEARS: to 4″ dia. x 1″ wide.

EXCLUSIVE DISTRIBUTORS, U. S. A.:

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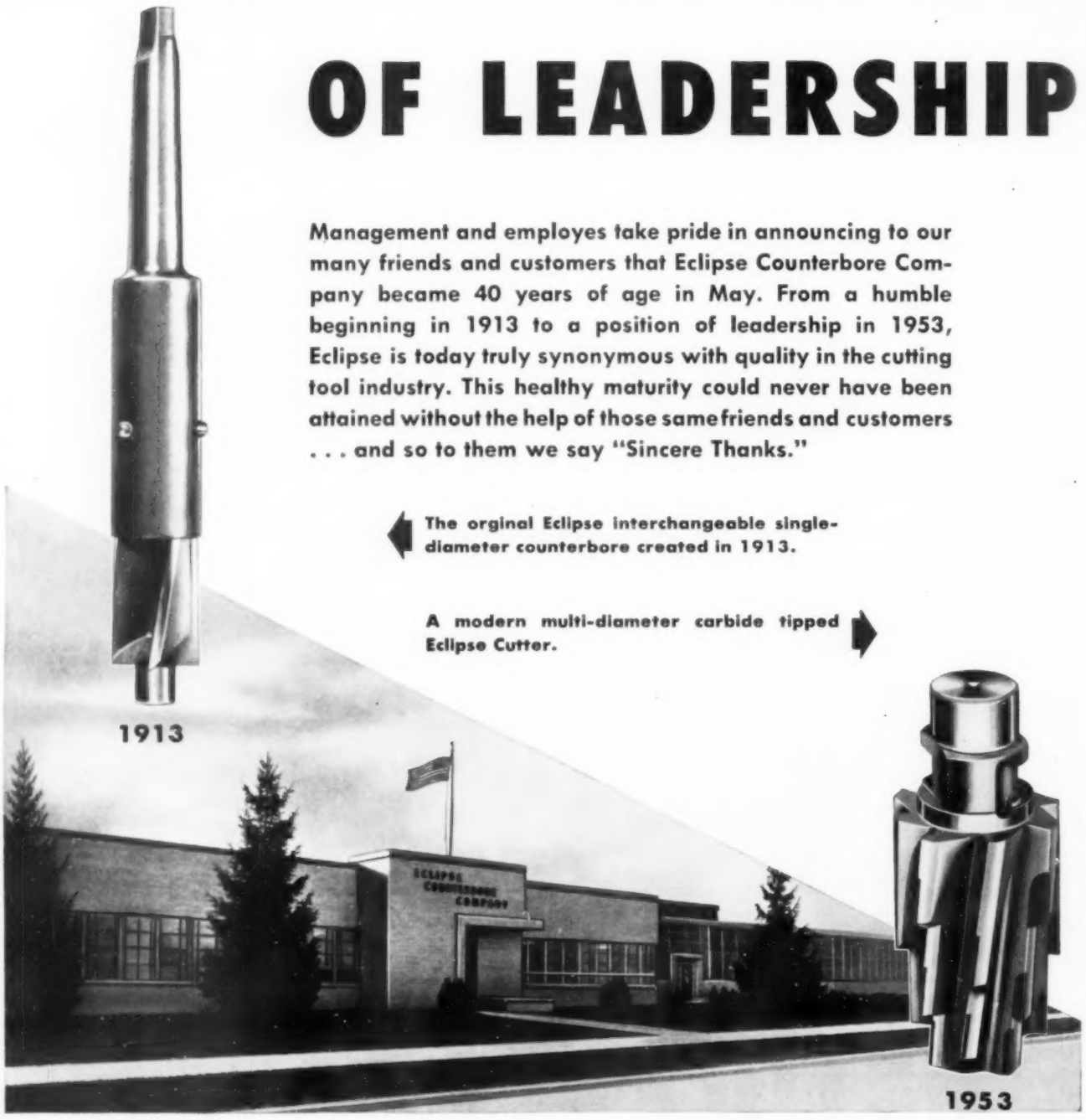
40 YEARS

OF LEADERSHIP

Management and employes take pride in announcing to our many friends and customers that Eclipse Counterbore Company became 40 years of age in May. From a humble beginning in 1913 to a position of leadership in 1953, Eclipse is today truly synonymous with quality in the cutting tool industry. This healthy maturity could never have been attained without the help of those same friends and customers . . . and so to them we say "Sincere Thanks."



The orginal Eclipse interchangeable single-diameter counterbore created in 1913.

A modern multi-diameter carbide tipped Eclipse Cutter.

ECLIPSE COUNTERBORE CO.

Founded in 1913

DETROIT 20, MICHIGAN

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Items listed below are available for individual ASTE members and chapters at nominal charges shown.

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Membership Emblem Button for Juniors and Seniors, enamel on gold		$ 1.00
Chapter Chairman's Emblem Button, gold with Rubies		11.00
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	500 for	5.00
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ASTE Banner, blue satin with gold lettering reading AMERICAN SOCIETY OF TOOL ENGINEERS and bearing ASTE emblem. Banner is complete with a rod inserted at the top and a gold colored cord for hanging.		15.00

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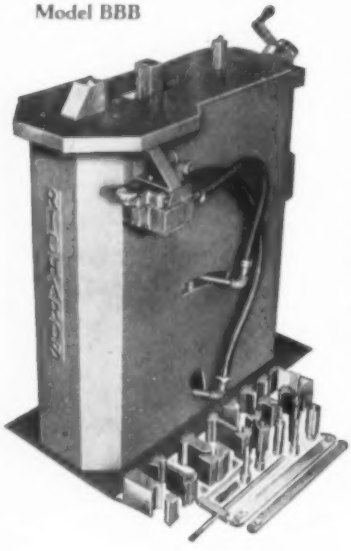
Produces Without Special Tooling—Saves Die Costs Saves on Expensive Presses

Model BBB



Illustrated above are a few of the many forms that can be produced efficiently on the Multiform Bender, using the standard tooling.

The heavy duty Big Brother Bender is designed for fabricating bus bars, brackets, fixtures, etc., without special tooling. Air controlled with finger tip response. Comes complete with dies, mandrels and wrenches—punching and blanking dies extra. Will punch holes up to 1" and form material up to ¼" thick by 4" wide. We also build smaller hand or air operated models for forming up to ⅜"x1½" material.

Send for illustrated folder TE-5

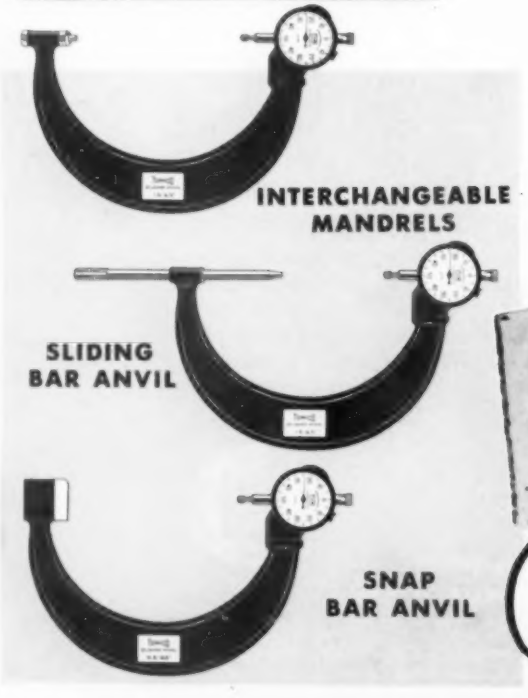
J. A. RICHARDS CO. 903 North Pitcher St Kalamazoo, Michigan

USE READER SERVICE CARD; INDICATE A-6-198-1

USE READER SERVICE CARD; INDICATE A-6-198-2

TUMICO DIAL INDICATOR GAGES

LIGHT • STRONG • FAST • ACCURATE



● Tubular frame construction assures light weight with maximum strength and rigidity plus advantage of minimum thermal expansion or contraction.

Tubular Indicator Gages are easier to use, speed production, reduce fatigue and encourage accuracy. Dial indicators give instant visual readings in English or Metric.

Indicators are attached to adjustable offset mount, not to stem, to avoid damage through rough usage. Gages furnished with interchangeable mandrels, sliding bar mandrels or snap gage block as desired. Standard sizes, 4½" to 54". Special larger sizes available.

Send for NEW CATALOG

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Send me latest information on precision gages, micrometers, dial indicators, calipers, rules, Verniers, etc. New ideas. New methods. Time savers.

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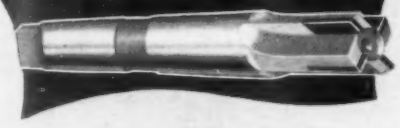
STANDARD CARBIDE TOOLS

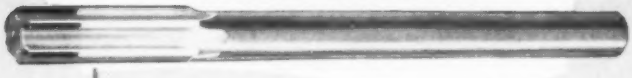
by SUPER

CARBIDE END MILLS



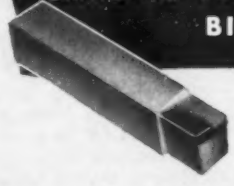
CARBIDE TWIST DRILLS

CARBIDE REAMERS

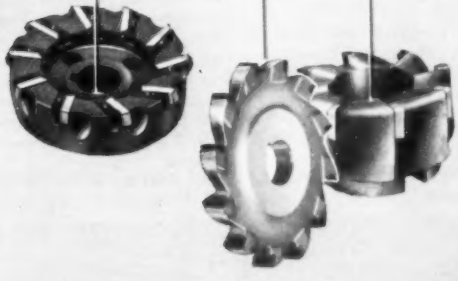


CARBIDE SPECIAL TOOLS

CARBIDE TOOL BITS



CARBIDE MILLING CUTTERS



The Super line of carbide tools features aggressive and up-to-the-minute thinking in cutting tool design. More than 50 items in a complete range of sizes are carried in stock in warehouses conveniently located in New York, Detroit, Chicago and Los Angeles.

Super
TOOL COMPANY

21650 Hoover Road, Detroit 13, Michigan

also 5210 San Fernando Rd., Glendale 3, California

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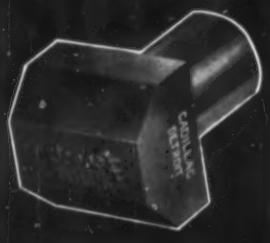
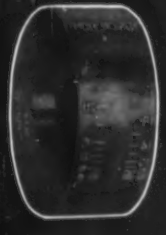
Higher production with CADILLAC Dies is assured by special steel selection, controlled heat treatment and precision engraving — noted for accuracy and high quality. We'll be glad to advise you on best marking methods.



PUNCH PRESS DIE

ROLL SEGMENT DIE



SOLID ROLL DIE

HEAVY BEVEL STEEL LETTERS AND FIGURES

The faces of CADILLAC Steel Letters and Figures combine a high degree of hardness with toughness, insuring exceptionally long life. Each stamp is clearly marked with character designation and size. Long tapering bevels assure easy alignment of characters. *(To the right, note CADILLAC's sturdily boxed Interchangeable Steel Type Set.)*

FORGING HAND STAMP

DIE INSERTS

EMBOSSING DIE

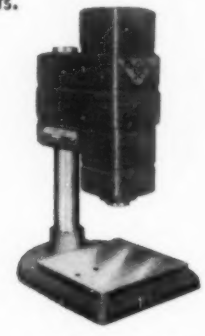
For Perfect Product Identification

There Are CADILLAC MARKING DEVICES Designed For ALL Marking Needs

Just as "variety" is called "the spice of life", varieties of marking methods and devices are essential for meeting modern production demands. CADILLAC STAMP COMPANY is equipped to offer or build every conceivable type of marking device, from simple hand stamps to especially created and designed machinery for unusual marking requirements.

CADILLAC 115 HAND MARKING MACHINE

For general purposes this floor type machine gives top service. Marking is done in a rolling operation—requiring minimum pressure. Marks flat or round parts of varying thickness. Foot pedal for marking flat or irregular contoured parts; table screw adjustable for round parts.



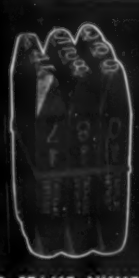
CADILLAC 52 AIR IMPACT PRESS

For high speed marking, assembling, branding, staking, crimping, riveting, also for producing light stampings. The 52 effects great savings in production — delivers speeds up to 10,000 strokes per hour—pressure up to 8 tons. Safe to operate, automatic controls. Can be hand, foot or electrically actuated.

CADILLAC 45 HYDRAULIC MARKING MACHINE

Here's a compact, self-contained, manifold mounted, hydraulic unit. One control gives full range of marking depth. It will mark round, flat and irregular surfaces. Machine capacity is up to 110 one inch impressions per minute.

Machines Above, Write for Bulletin M-120
Misc. Items, Write for Bulletin SE-130.



HAND STAMP NUMERALS

INTERCHANGEABLE TYPE AND TYPE HOLDER SET

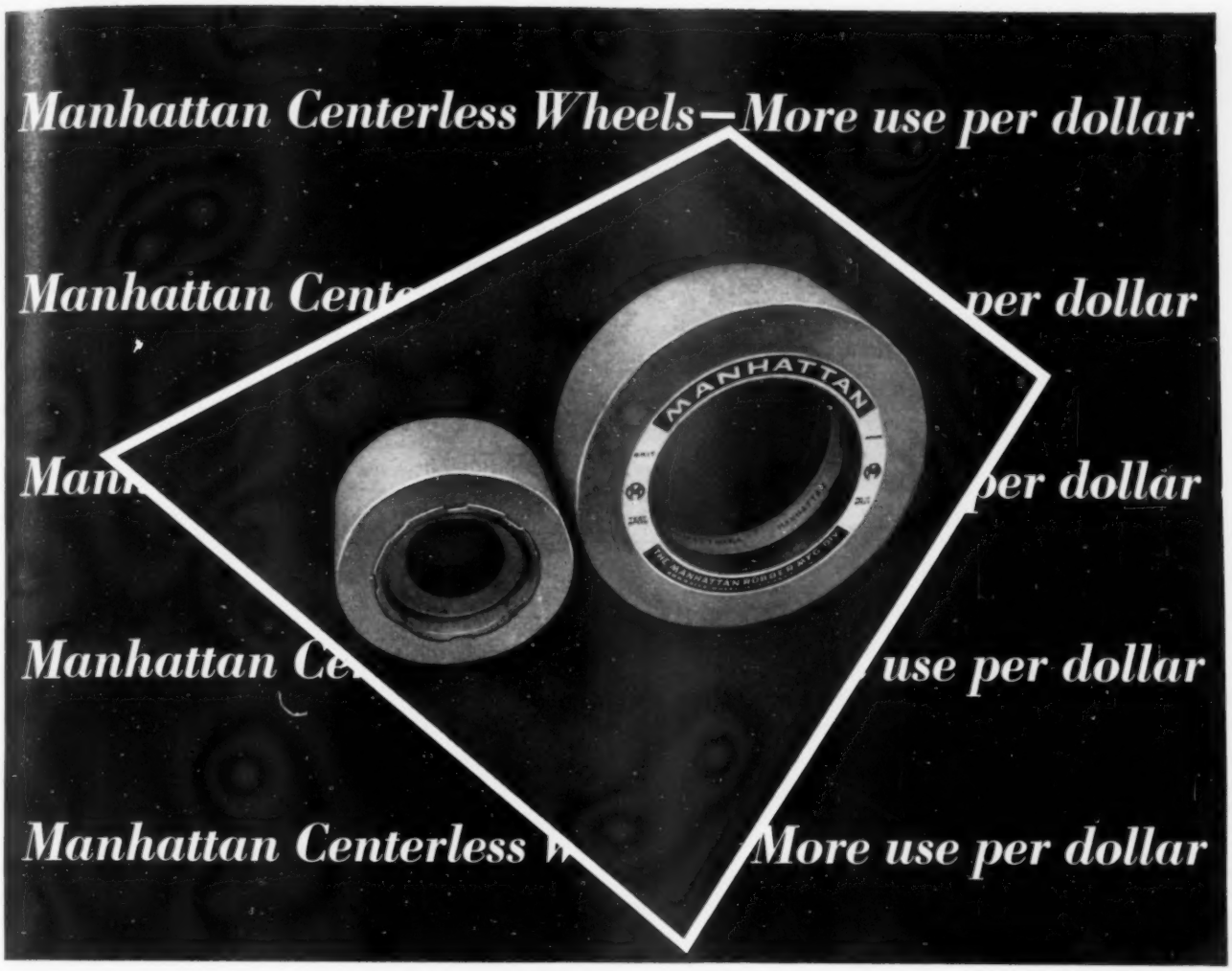
HAND STAMP SYMBOLS

CADILLAC
Marking Devices

CADILLAC STAMP COMPANY

Factory and Offices

17313 Ryan Road • FO. 6-0500 • Detroit 12, Mich.

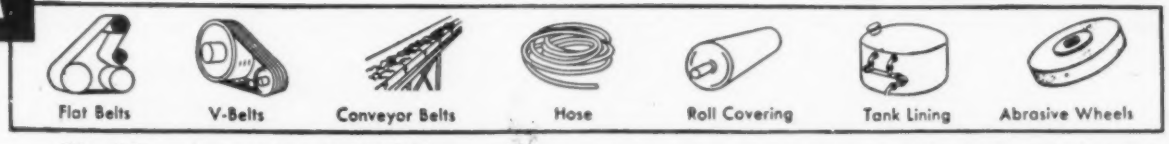


ROUGHING AND FINISHING—WITH THE SAME WHEEL. With Manhattan Rubber Bonded Centerless Wheels fewer passes are necessary to obtain stock removal to required tolerances and desired finish. The same Manhattan Centerless Wheel used for *roughing* can be used for *finishing* by controlling the feed rate and amount of stock removed. This is the advantage of the higher grit-carrying capacity of Manhattan's rubber bond, and its unique ability to produce good finishes even with coarse grain particles. The greater strength of Manhattan Rubber Bonded Centerless Wheels also permits *high speed* grinding (8500 sfpm). You get more production at lower cost . . . MORE USE PER DOLLAR from Manhattan Rubber Bonded Centerless Wheels . . . Manhattan Regulating Wheels are supplied either plain or core mounted. Manhattan Core Mountings also result in substantial production savings. Get the details in Bulletin 6925.

WRITE ABRASIVE WHEEL DEPARTMENT

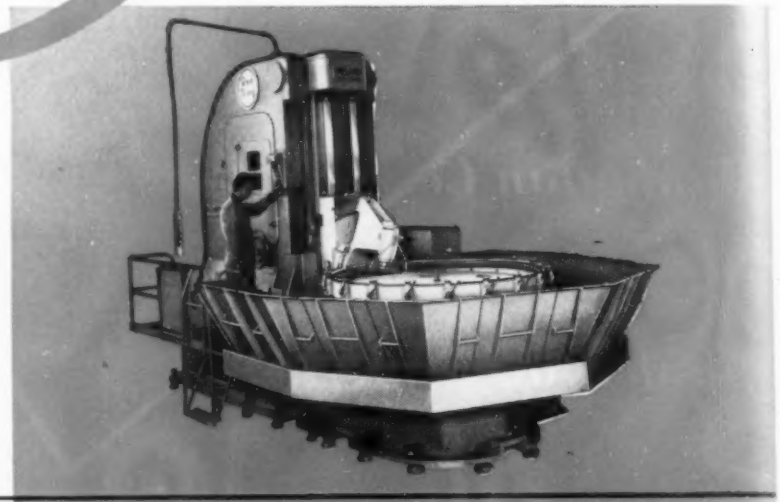
MANHATTAN RUBBER DIVISION — PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.



Other R/M products include: Industrial Rubber • Fan Belts • Radiator Hose • Brake Linings • Brake Blocks • Clutch Facings Asbestos Textiles • Teflon Products • Packings • Sintered Metal Parts • Bowling Balls

Large marine gear finishing practice moves ahead

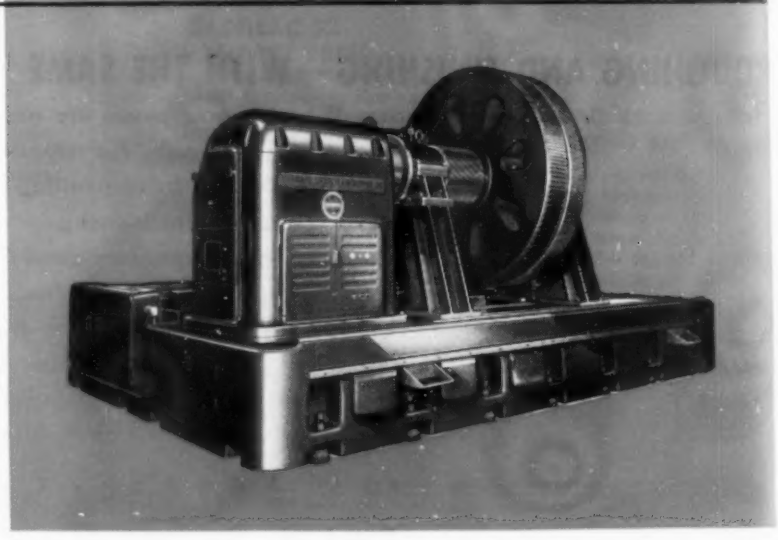


ABOUT 11 years ago the first Red Ring machine for shaving large marine propulsion gears (up to 96" PD) was completed and put into commission. Its high precision and spectacular economy promptly initiated the now accepted practice of shaving for such gears.

Since then Red Ring machines have been built to shave larger ma-

rine gears. The United States, our fastest and largest ocean liner, launched last year, is driven by reduction gears shaved on Red Ring machines.

And now, nearing completion is a giant shaving machine to finish marine gears 15 feet in diameter to almost incredible tolerances on tooth form, pitch, lead and surface finish. With slight modifications, this unit will handle gears up to 200" PD. It will be displayed to this company's guests late in April.



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WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

6282

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Photograph by Paul Davis

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Built into every Card tap are years of concentration on one ideal — to build the best taps money can buy.

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VK WIRE TYPE PLUG GAGES

VASTLY LONGER-LIVED and MONEY SAVERS . . . because they're "Cut-Off-Able" as well as "Reversible"

As a Van Keuren agent put it, "They're not only reversible, they're cut-off-able." And that means when you buy Van Keuren Wire Type Plug Gages, the sizes below 3/8" may be cut off when ends become worn and as many as from five to ten gages made available from the 1 7/8" and 2" long units. It is not only economical and practical to use Van Keuren Gages but it is a very simple operation to cut off the ends by following instructions furnished on request. The illustration above shows clearly the cut-off and reversible features.

VK Wire Type Gages are available in ZZ to XX accuracies in sizes from .001" to 1.000". They are furnished in alloy tool steel, high speed steel, chromium plate or tungsten carbide. Whatever the gaging job, the extra length provided in VK units will save you money. It will also pay you to take advantage of VK deliveries. In many cases we can ship your requirements from stock.

VK Wire Type Plug Gages are fully described in Catalog & Hand Book No. 35, available on request by writing to: The Van Keuren Co., 174 Waltham St., Watertown, Mass.

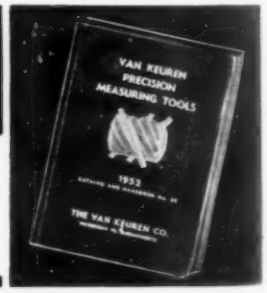
VK

34th YEAR

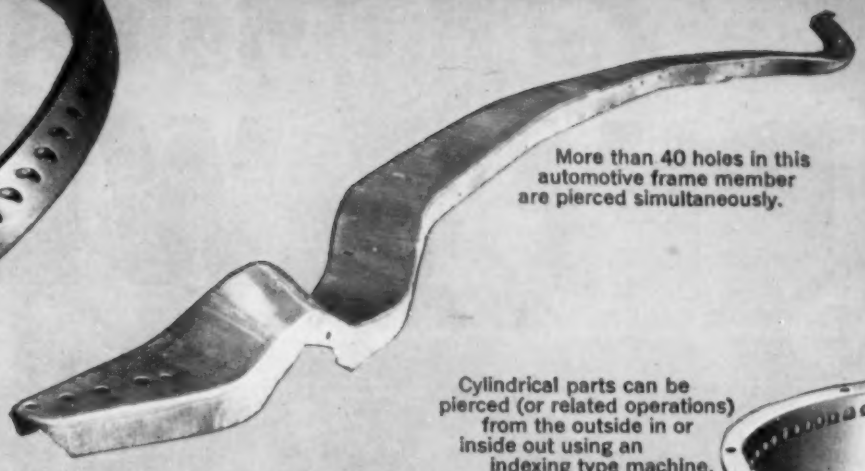
THE Van Keuren CO.,

174 WALTHAM STREET, WATERTOWN, MASS.

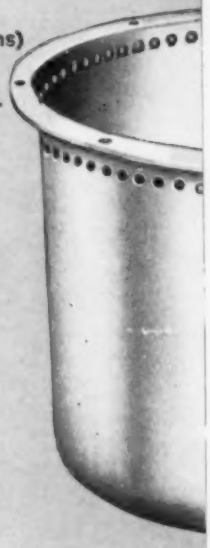
Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Cemented Carbide Plug Gages • Carboloy Cemented Carbide Measuring Wires



Irregularly shaped holes are pierced in this stainless steel jet engine part to very close tolerances—automatically.



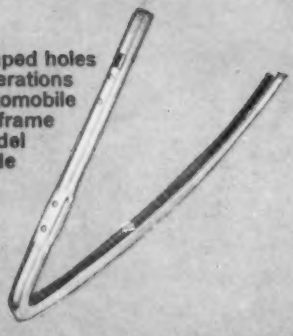
More than 40 holes in this automotive frame member are pierced simultaneously.



Cylindrical parts can be pierced (or related operations) from the outside in or inside out using an indexing type machine.

High Production Piercing...

IN A SINGLE SET-UP



Seven irregular shaped holes and two trimming operations complete this automobile door inner window frame in one setup. Model changes can be made at little expense.

Based on a recent development in piercing technique, you can pierce more holes simultaneously—faster and with greater accuracy—on Danly Metalworking Equipment. Eliminate awkward multiple handling . . . pierce all holes faster in a simple, single set-up.

Built specifically for your piece part, these are only a few of the advantages of Danly Hydraulic Metalworking Equipment:

FREE

Write for this bulletin today!

Consider these important features!

- ***HIGH CAPACITY***— Up to 225 tons available per cylinder.
- ***BREAKTHROUGH SHOCK PRACTICALLY ELIMINATED***— Permits greater capacity without hydraulic circuit or tool trouble . . . smoother, faster.
- ***AUTOMATIC STRIPPING***— An integral feature of every cylinder . . . each station hydraulically strips its punch. This unique action simplifies fixturing, is practically foolproof.
- ***ACCURACY, FLEXIBILITY***— Pierces practically any type of hole . . . round, oblong or irregular to very close tolerances.

DANLY®

DANLY MACHINE SPECIALTIES, INC.
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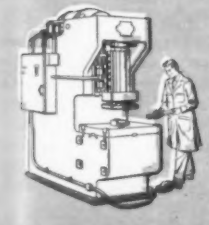
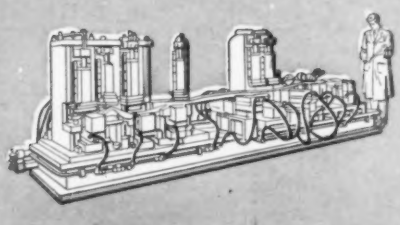
HYDRAULIC METALWORKING EQUIPMENT
MECHANICAL PRESSES . . . 50 TO 3000 TONS

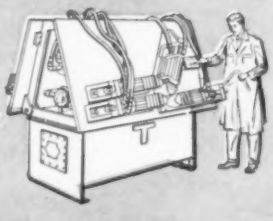
DANLY HYDRAULIC METALWORKING EQUIPMENT



General Purpose Gap Frame Piercing Press



Automotive Frame Piercing Machine



Automotive Inner Window Frame Piercing Machine

Jet Engine Shroud Ring Piercing Machine

Get on the right track to

BEAT WEAR

Nordberg Mfg. Co.
Milwaukee, Wisconsin

The Product: Nordberg Hydraulic Power Jack used to lift rails and ties from roadbed during reballasting or resurfacing.

The Problem: To keep wear in the moving parts of the hydraulic rams to a minimum. Because the piston and gland act as guides, close tolerances must be maintained. In addition, the hydraulic ram utilizes pressures of 3000 psi and, although the piston has "O" rings with back-up washers, extremely close fits must be maintained between piston and gland to hold this pressure.

The Solution: AMPCO METAL for both piston and gland.

The Results: Thanks to the ability of Ampco Metal to resist wear, proper clearances and tolerances are maintained. The result — dependable performance, greater output.

IT'S PRODUCTION-WISE TO AMPCO-IZE

◆ **Nordberg Track Jack in operation. Machine consists basically of two hydraulic rams, each capable of lifting 24,000 lbs. Ampco Metal is used in the moving parts of the hydraulic rams because of its excellent resistance to wear.**

use AMPCO* METAL

One of the easiest ways to beat wear is to use Ampco Metal. That's why more and more designers and plant-operating men turn to these versatile aluminum bronze alloys. They know that Ampco Metal builds extra toughness and stamina into their machines — toughness and stamina that mean longer service life, more dependable performance, lower costs.

And unusual resistance to wear isn't the whole story. Ampco Metal has high compressive strength — doesn't squash out. It resists abrasion, erosion, corrosion. It has high impact and fatigue values, and excellent bearing qualities.

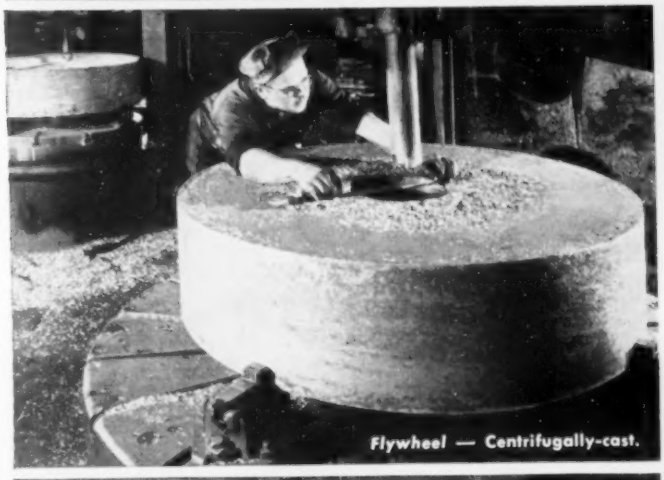
You can get Ampco Metal in practically any form you need — sand and centrifugal castings, sheet, plate, forgings, bars, tubes, welding wire and electrodes.

Beat wear! Use Ampco Metal in both your product and plant — for that all-important extra margin of safety and dependability. For the complete story, contact your nearest Ampco field engineer or send the coupon.

Tear out this coupon and mail today!

*Reg. U. S. Pat. Off.

Gear for metal spray gun — Extruded-rod.



Flywheel — Centrifugally-cast.

Blade bushing for airplane propeller — Centrifugally-cast.

Be Cu

Beryllium Copper is now available, both cast and extruded. Your inquiries invited.

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I'm interested. Send me your free Ampco Metal literature giving descriptions and general applications of Ampco Metal.

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9-1

Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

INTRODUCING BEARCAT TOOL STEEL

Super Shock-Resisting ...Versatile, Too!

Here's a brand-new tool steel that we've been developing over the past several years. Proven in a wide variety of production tools and dies, Bearcat is a general-purpose steel especially suited for uses where shock-resistance, hot-work properties and easy machining are important.

Some of Bearcat's big features:

- Super shock-resistance
- Deep-hardening . . . in air
- Easy to machine (Brinell 197 max)
- Low distortion in heat-treatment
- Good hot-work properties
- Easily carburized for long wear

These are not just claims made for a new, untried steel! Bearcat has been thoroughly tested in applications such as rivet sets, hot gripper dies, punches, chisels, moil points, forming dies. All of the possible uses for Bearcat have not yet been explored, but we expect it to be ideal for hot headers, blanking dies, master hobs, machined-cavity molds, and many general-purpose tools and dies.

Bearcat is stocked in our mill depot and it's also available through your local Bethlehem tool steel distributor.

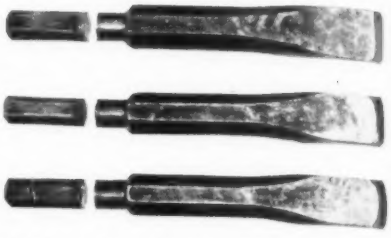
Typical analysis:

C	Mn	Si	Cr	Mo
.50	.70	.27	3.25	1.40

Complete data may be had by writing us for Booklet 341. Address your request to Room 1037, Publications Dept., Bethlehem Steel Co., Bethlehem, Pa.

BEARCAT DRIVES 27 TIMES MORE HOT RIVETS

Here's one example of what Bearcat can do on a job that calls for both shock-resistance and good hot-work properties. This typical rivet set, made from Bearcat, drove 43,094 rivets and was still in good condition. Rivet sets made from carbon tool steel, and used under similar conditions, drove an average of only 1566 rivets before recupping was required.



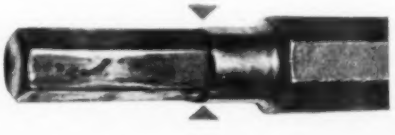
All of the chisels broke in service at the sharp change of section. While this is classed as a mechanical error, it does show how improper design can cause failure no matter how carefully a tool may be heat-treated.

Chisel Breakage Cured by Undercutting Shanks

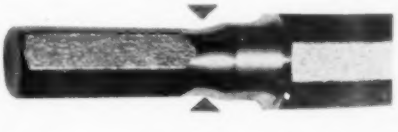
A large user of chisels — made from a top-grade shock-resisting steel, Bethlehem Omega — reported excessive breakage. One of our metallurgical sleuths soon put his finger on the trouble.

When the hexagon shanks were milled by the customer, a milling cutter was used which did not have an adequate radius. As a result, stresses were concentrated at the sharp change of section in the shank. Subjected to heavy impacts in air hammers, the chisels broke prematurely — and always at this portion of the shank.

The solution for the breakage was one that really surprised the customer. See photographs below.



This shank shows the "stress raiser," caused by the lack of sufficient radius, where the milled hexagon section meets the round section.



All of the unused chisels were salvaged by having an undercut ground on the shanks so that a ½-in. radius was provided at the source of the trouble. Despite the smaller section, these chisels gave good service. The sharp change in section was eliminated, stresses were better distributed.

THE BETHLEHEM TOOL STEEL ENGINEER SAYS:

High-Carbon Tool Steels Can Be Carburized

Many people don't realize that carburizing can be accomplished with the high-carbon, high-chromium steels — such as our Lehigh H, which contains 1.55 pct carbon and 11.50 pct chromium. The carburizing of tools made from such steels can be either helpful or harmful, depending upon whether the carburized case is produced intentionally or accidentally.

Tools intended for light loads and long service, such as lamination dies, are often intentionally carburized before quenching. Such dies have greatly improved resistance to wear because of the carbon added to the wearing surfaces. The usual procedure is to use carburizing compound as a packing medium and heat for the normal length of time at the quenching temperature.

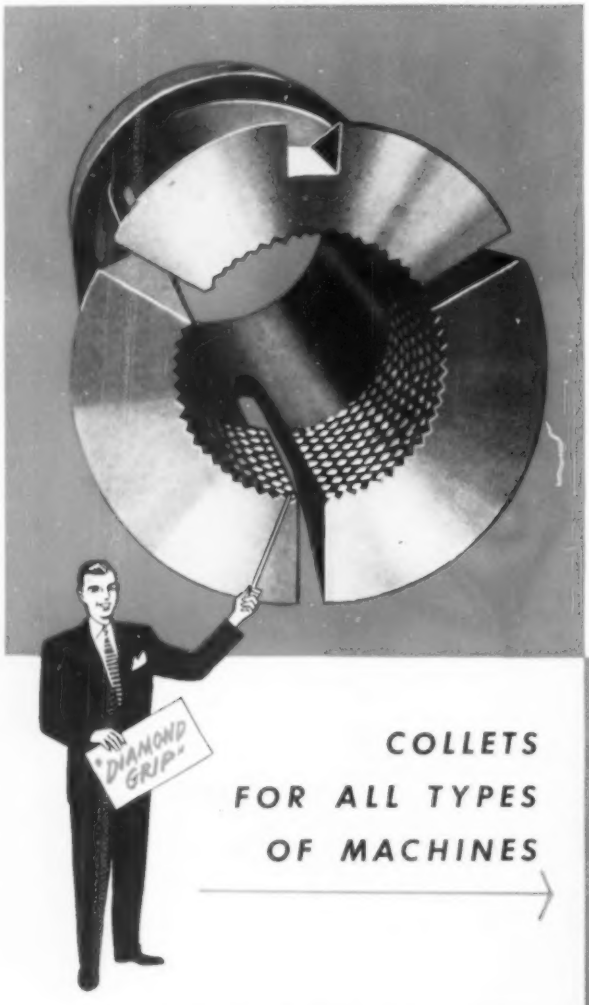
Sometimes an accidental carburized case results when "spent" carburizer is used as a protective packing medium when heating for hardening. Spent carburizer is often almost as active as new carburizer. An accidentally produced carburized case is not always harmful. It may even be helpful. But there are many heavy-duty tools and dies that will develop chipped or spalled edges if they become carburized. When treating tools of this type, use cast-iron chips as a packing medium during hardening.

COMPLETE VARIETY OF

SIZES AND LENGTHS IN

UNIVERSAL SUPER FINISHED DRILL BUSHINGS

Check these features that make Universal drill bushings outstanding: 1. Super finish reduces wear to a minimum. 2. Blended radius reduces tool hang up. 3. 100% concentricity and hardness tests assure accuracy. 4. Knurled head provides quick sure grip. Order from the office nearest you ... 1060 Broad St., Newark, N.J., 5035 Sixth Ave., Kenosha, Wis., or write direct to our home office.



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Sutton Collets and feeders!

COLLETS FOR ALL TYPES OF MACHINES

All Popular Sizes Carried in Stock For Immediate Delivery!

Sutton Collets satisfy thousands of users because they run true and they hold true! The famous "Diamond Grip" serrations, exclusive in Sutton collets, attack horizontal and rotating thrusts at an angle—work is gripped tighter, spoilage is reduced, life of chucking mechanism is prolonged under a reduced tension, and the collet is self-cleaned of scale, chips and dirt.

Uniform Temper and Tension

Equally important is Sutton's modern and exclusive heat treat method, which localizes controlled heat to give uniform spring temper on all collets and uniform tension on all feeders. This uniformity of temper and tension provides added useful life to the collet and feeder, thus saving greatly on down-time.

Write for Catalog 18

26 pages complete with valuable collet and feeder information and specifications. Sent Free!

SUTTON COLLETS

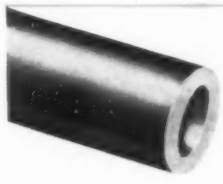
FEEDERS and TOOLS

Sutton Tool Co., Dept. TE-6, Sturgis, Mich.

Suttons Run as True as the Spindle

you're missing something
if you fail to remember

CRUCIBLE HOLLOW TOOL STEEL



Manufacturers of ring-shaped tool steel parts who don't use Crucible Hollow Tool Steel in their operations are missing a good bet. Already, some users have cut just their material costs as much as 20% by using it in place of regular bar stock.

This hollow form of Crucible tool steel is available in three famous grades: KETOS, AIRDI 150 and SANDERSON. And it is supplied with machine finished inside and outside diameters and faces — cut to your specific length requirements.

With Crucible Hollow Tool Steel, toolmakers can now eliminate drilling, boring, cutting-off and rough facing operations. This, of course, reduces production time, increases machine capacity and cuts scrap losses.

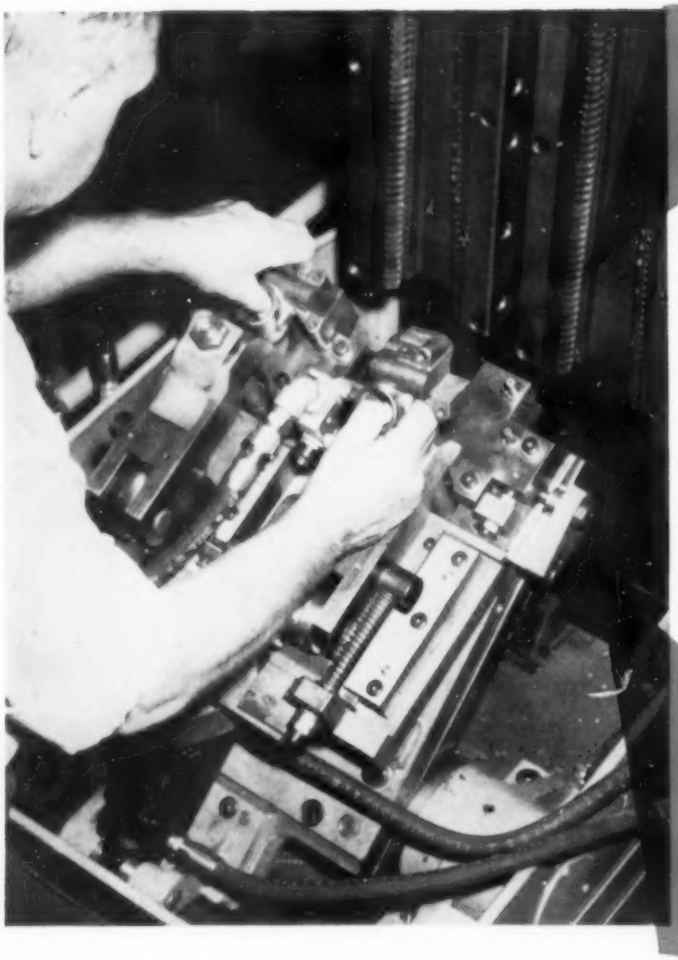
For further information, call your nearest Crucible warehouse . . . or write for new brochure describing Crucible Hollow Tool Steel, Dept. T, Crucible Steel Company of America, Chrysler Bldg., New York 17, N. Y.

CRUCIBLE first name in special purpose steels

53 years of Fine steelmaking

HOLLOW TOOL STEEL

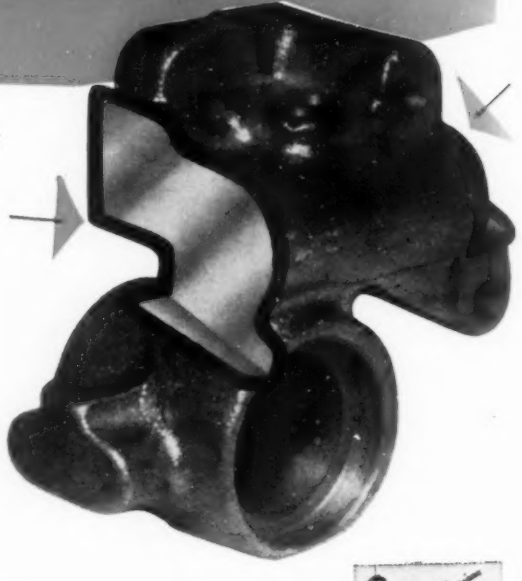
CRUCIBLE STEEL COMPANY OF AMERICA • TOOL STEEL SALES • SYRACUSE, N. Y.



FIXTURE AUTOMATICALLY TILTS, CLAMPS PARTS for GENERATING TYPE BROACHING

Illustrated are the two parallel surfaces broached in one pass on the American SB-42-10 single ram surface broaching machine equipped with a completely automatic fixture.

Speeds production of parking brake brackets designed and built the American way.



Two parallel surfaces on each of two parts are straddle broached in one pass on this American SB-42-10 single ram broaching machine. Over 350 of these intricate parking brake brackets are completed every hour.

The complete tooling designed the American Way features:

1. **Generating type broaches.**
2. **Fully automatic work holding fixture with tilting table.**
3. **Automatic clamping and unclamping of parts.**

The operator simply loads and unloads the parts, starting each machine cycle by push button control.

For the answer to your broaching problem send a part-print or sample and hourly requirements to American . . . the organization that gives you the extra advantages of experience in producing all three . . . broaches, machines and fixtures. No obligation. Address Dept. T.

For more information on the American SB-42-10 and other American machines, write for Circular #300.

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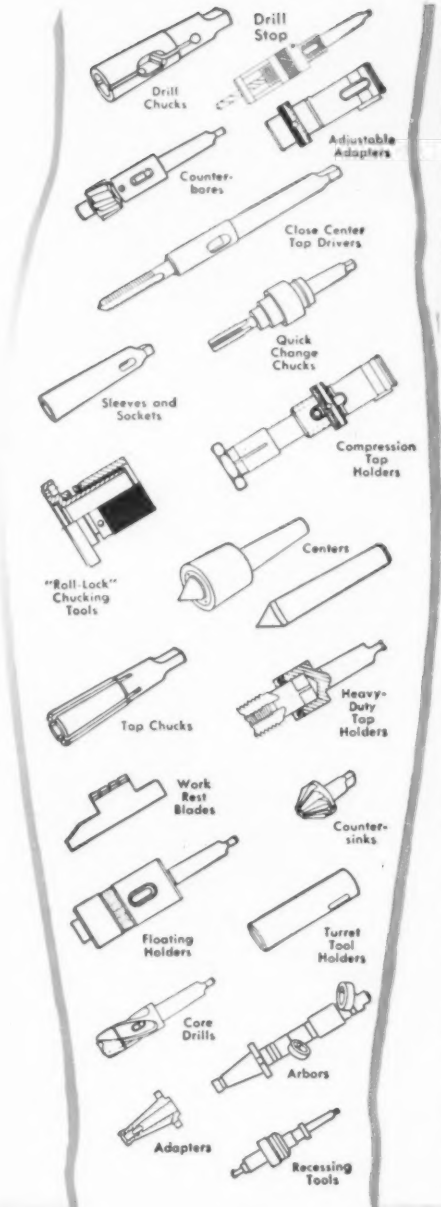
American Building - Ann Arbor, Michigan

SUNDSTRAND

See American First — for the Best in Broaching Tools, Broaching Machines, Special Machinery



the "ARMS and HANDS" for your MACHINE TOOLS

If you think of a Lathe, Mill, Multi-Spindle Machine, or other Machine Tools as being a human body, supplying power to the parts of the body doing the actual work, then Scully-Jones tools represent the "Arms and Hands"

FOR MULTIPLE SPINDLE MACHINES

NEW SJ SCULLY-JONES "JT" FLOATING TAP HOLDER

Comparable to the "JA" Floating Holder, which has thoroughly proven itself in the field, the new "JT" is designed for use in multiple spindle machines. It has double gear spline drive, with clearance between mating splines that allows free movement of floating and driving elements for uniform tapping operations.

LESS OVERHANG

The short projection requires less space between spindle and work.

WORK ON CLOSE CENTERS

Small body diameter permits operations on close centers.

REDUCES TAP DAMAGE

Collet is split on 4 sides; centers tap by the shank, reducing strain and tap damage. Thrust bearings permit cutting tools to float freely into alignment.

SHORTENS SET-UP TIME

Quick-Lock Nut Locks any place on the threaded adapter shank, making it easy to adjust for depth.

TROUBLE-FREE OPERATION

Balls, in the 2 thrust bearings, are free to move or rotate around the collet because they are separated from the drive. This reduces destructive scrubbing action which prevents free float.

REDUCES WEAR

Wear of floating elements is practically eliminated, due to positive lubrication of all parts during operation.

SHUTS OUT DIRT

Outer shell with its "O" ring is a perfect seal to retain lubricant and keep out chips and dirt.

ASK FOR "JT" BULLETIN

Scully-Jones AND COMPANY

2915 So. Rockwell St., Chicago 8, Ill.

YOU GET LOW COST, FAST, ACCURATE PRODUCTION WITH OUR STANDARD AND SPECIAL TOOLS

YOUR PROBLEMS ARE OUR PROBLEMS

Helping you solve your tooling and production problems is Scully-Jones first objective. Ever since 1912 we have designed, developed and manufactured tools to the highest standards to help you get fast, accurate production at low cost.

That is why you can purchase S-J Tools and get the best that engineering research, modern equipment, correct materials and expert workmanship can produce.

Use these S-J "Arms and Hands" to equip your machine tools. They will help you get low cost, fast, accurate production on such operations as drilling, reaming, tapping, milling, counterboring, countersinking, core drilling, recessing or undercutting, boring and grinding.

For current information on S-J Tools, refer to Catalog 600. Write on your company letterhead for your copy.

Let us help you solve your tooling and production problems. Because our manufacturing facilities have been expanded, we're in a position to give you reasonable deliveries. For quick service see our nearest representative or contact Scully-Jones direct.

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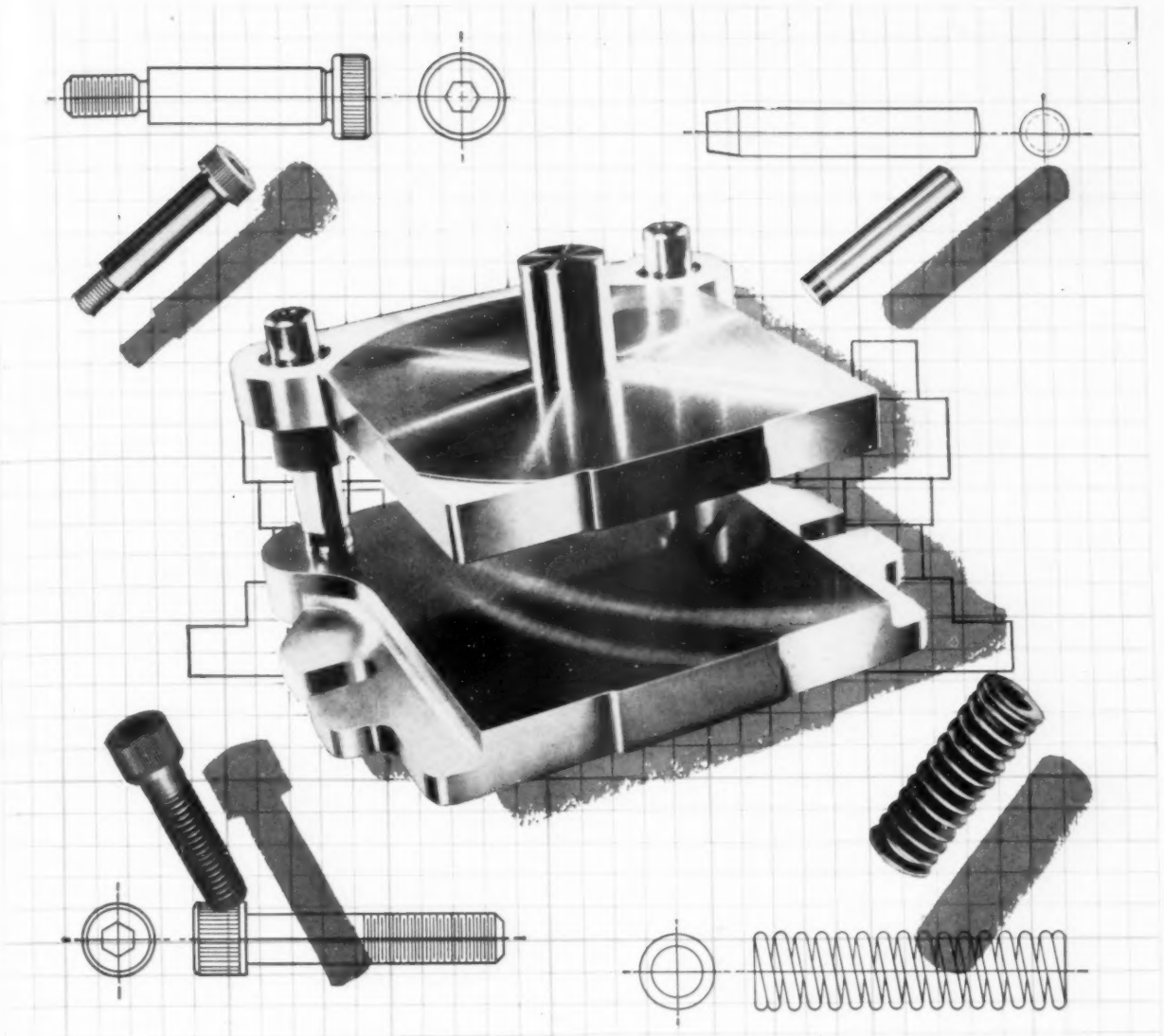

THERE'S A DANLY STANDARD TO MEET YOUR DIEMAKING SPECIFICATIONS

In nearly every instance, Danly can meet your diemaking specifications with *standard* Danly Die Sets and *standard* Danly Diemakers' Supplies. Eliminate delay between design and production . . . you can be sure of prompt delivery from completely stocked Danly branch assembly plants located in major toolmaking centers.

More than 30 years' experience in supplying diemakers' needs has established Danly's reputation for design excellence and dependable accuracy. Diemakers everywhere *prefer* Danly!

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MILWAUKEE 2—111 E. Wisconsin Ave.
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*Indicates complete stock

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GOLF CLUB HEADS GET THE "TOUCH OF GOLD" as they are precision polished to the desired weight and finish on a grease wheel coated with ALUNDUM* Abrasive.

For your product-improving "TOUCH OF GOLD" —polish with ALUNDUM Abrasive

For polishing that has the true "Touch of Gold" — that adds most to the usefulness and attractiveness of your products — there's nothing to equal Norton ALUNDUM Abrasive grain.

Made under Norton's strict quality control, ALUNDUM Abrasive is extremely hard and tough, always uniform in grain size and shape, with a maximum of fast polishing, sharp-cutting edges. No oversize grains to mar the finish; no undersize grains or slivers that won't do their share of the work. And its high capillarity means the easy glue-absorption that increases polishing wheel life and efficiency.

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of the exact types of ALUNDUM Abrasive you need. He's backed by complete stocks in Chicago, Detroit, Cleveland, Philadelphia, Pittsburgh and Worcester, ready for shipment in container sizes to meet every requirement. And if necessary, he'll gladly call your Norton Abrasive Engineer for expert aid in your polishing problems. Or you can write to Norton Company, Worcester 6, Massachusetts. Distributors in all principal cities. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Massachusetts.

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ABRASIVES
Making better products to make other products better

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The fable of

The Three Brothers

HOLDS A LESSON FOR CUTTING FLUID USERS

The Fable

THREE brothers inherited equal shares of their father's farm. One brother feverishly worked his land, with seldom a rest, until prematurely worn out, he died at an early age. The second brother loafed and played until his land went to ruin and he died for want of food. The third brother, wiser than the other two, *balanced* his work and play, so that he prospered mightily and lived to a ripe old age.

The Lesson

BALANCING cutting fluids produces best results, too. The *proper balance of chemical activity* will provide the longest possible tool life consistent with surface finish desired.

Figure 1 shows abnormal front clearance wear of a single point tool due to *excessive* chemical activity of the cutting fluid used. The tool failed prematurely, just like the first brother in the fable.

Figure 2 shows abnormal cratering of a tool due to *insufficient* chemical activity of the cutting fluid used. Such cratering is usually associated with poor surface finish. This tool failed prematurely like the indolent brother in the fable.

Both of the above examples of tool failure were developed under identical conditions, except for the degree of chemical activity of the cutting fluids used.

The *proper balance of chemical activity* gives the most profitable results. For the right cutting fluids for your work, ask to have your Stuart Oil Representative call. Use the handy coupon below.

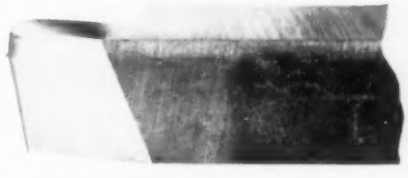

FIG. 1—Abnormal front clearance wear caused by excessive chemical activity of cutting fluid.

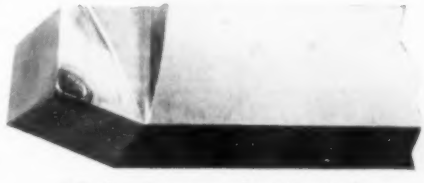

FIG. 2—Cratering of cutting tool, usually associated with poor finish, resulting from insufficient chemical activity of cutting fluid used.

More Than a "Coolant" is Needed

D. A. Stuart Oil Co.
EST. 1865 LIMITED

TIME-TESTED CUTTING FLUIDS AND LUBRICANTS

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Check One ☐ Have Stuart Representative Call
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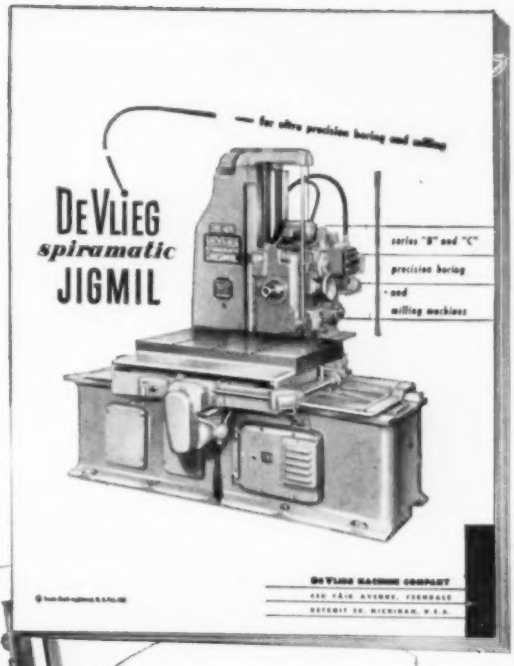

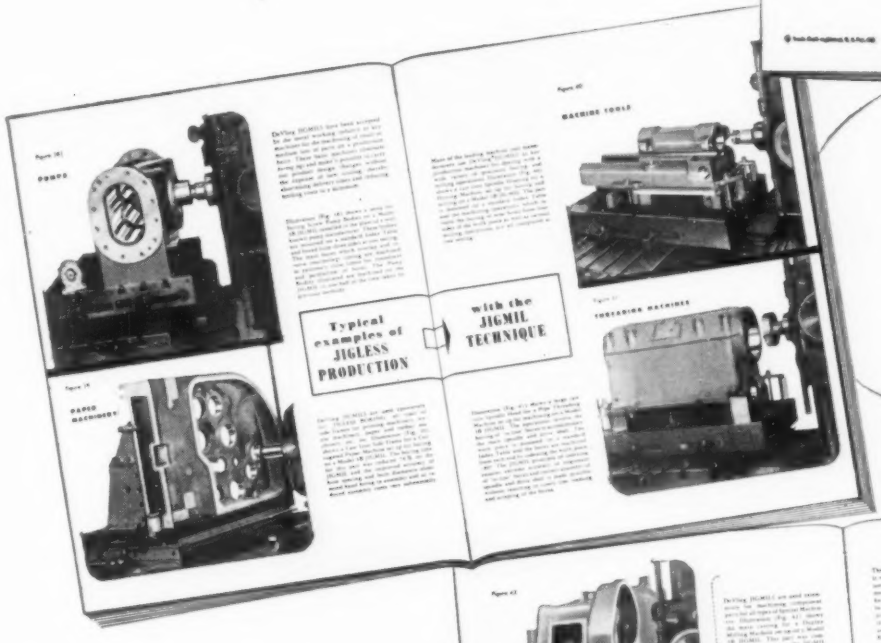

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for the latest developments in precision boring equipment . . . consult

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FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-6-225

An open letter to potential buyers of special machine tools and special tooling

Now, we can offer you greatly expanded facilities for the solution of your specific metalworking problems

FOR 55 years we've been designing and building special machine tools — as well as tooling and adaptations for standard equipment. But because of limited facilities, we could serve only a minimum number of you as customers in this ever expanding and increasingly important market.

Frankly speaking, we have decided that the time has come when we must be able to serve more of you. To do this job right, we are now completing a $5,000,000 plant expansion to handle this work — to help you solve your special production problems with special machinery and special tooling, big — or small.

Here are our qualifications:

EXPERIENCE: We've been in the business 55 years. During that time we have designed and built over 60,000 standard and special machine tools. *In recent years, our production of special machinery has ranged up to four million dollars annually.*

FACILITIES: Our new expansion is devoted exclusively to the production of special machinery. The new plant, built on a site covering 38 acres, is equipped with *over $2,500,000 worth of the very latest tools and equipment* — many of them custom-built for the job.

PERSONNEL: Our Special Machinery Division engineering section has at its command nearly *100 experienced, imaginative and practical design and project engineers* . . . men fully qualified in the sciences of applied mechanics, hydraulics, electronics and metallurgy . . . and metalworking.

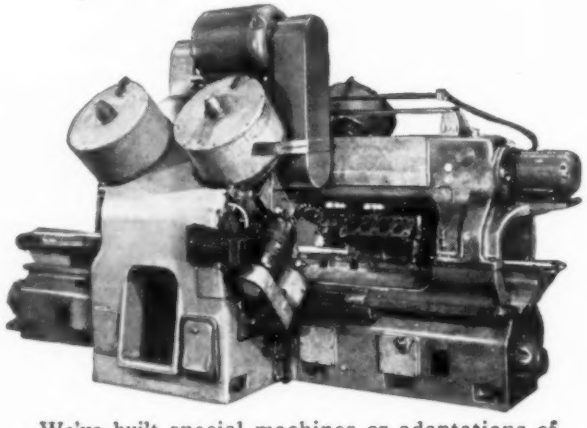
PERFORMANCE: Kearney & Trecker's Special Machinery Division is best recommended by its outstanding record of successfully solving many hundreds of unusual machining problems . . . problems that involved demands for high volume production, as well as exacting dimensional accuracy and fine surface finish.

RESPONSIBILITY: Our Special Machinery Division is an integral part of the Kearney & Trecker Corporation . . . and is fully supported by all its financial and physical resources. Any commitment for a product of this division is a commitment that fully involves the accepted reputation for responsibility and satisfaction that is Kearney & Trecker's.

We invite your inquiry

We'll be glad to provide you with any information we can . . . including sample machine specification sheets on typical installations, a brochure covering the expanded facilities of our Special Machinery Division, and details on our Customer Engineering Service. Furthermore, if you have special production machinery problems, have one of our senior Project Engineers analyze them, without obligation, of course.

Write, wire or phone the Special Machinery Division, Kearney & Trecker Corp., 6784 W. National Ave., Milwaukee 14, Wisconsin.



We've built special machines or adaptations of standard equipment for practically every industry. Here is a photo of a transfer-type milling machine we designed and built for a major automotive manufacturer.

SQUEEZE PLAY

35 ton "Hy-Power" Riveter attaching brake backing plate assembly to rear axle housing with cold rivets.

. . . on riveting costs

Here's why manufacturers of autos, trucks, farm implements and other fabricated metal products use Hannifin "Hy-Power" Hydraulic Riveters:

"Hy-Power" formed rivets cost less . . .

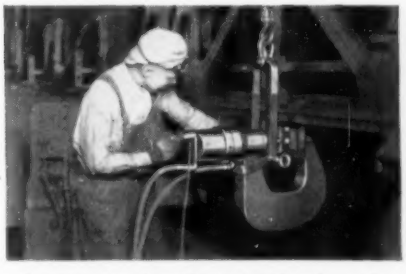
ONE MAN RIVETING. No bucker-up needed. Hannifin light weight, forged C-frames are easily maneuvered and positioned by one man.

FASTER RIVETING. Even unskilled operators head ⅜" rivets in 2½ seconds. A single control button starts and stops the automatic cycle.

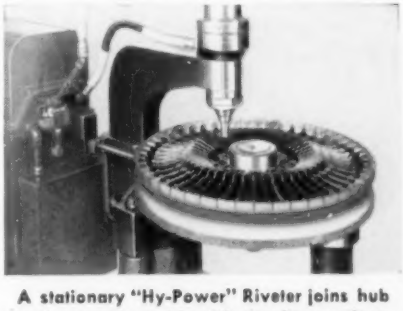
STRONGER JOINTS. This "silent squeeze" method, hot or cold, expands rivets to fill holes completely; forms fillets under both heads for extra strength.

SELF-CONTAINED, QUIET. The Hannifin "Hy-Power" Hydraulic Pressure Generator quietly supplies pressure to the "Hy-Power" cylinder which does the work. These cylinders are available in 7½, 10, 12½, 17½, 25, 35, 50, 75 and 100-ton capacities.

OTHER OPERATIONS, TOO. In addition to riveting, Hannifin "Hy-Power" equipment is used for staking, punching, forming, pressing and bending. Write for your copy of Bulletin 150.



One man handles this 50-ton "Hy-Power" Riveter with effortless ease in working on railroad car underframes.



A stationary "Hy-Power" Riveter joins hub and runner assembly of hydraulic couplings.

HANNIFIN

Hannifin Corporation, 1119 S. Kilbourn Ave., Chicago 24, Illinois

Air and Hydraulic Cylinders • Hydraulic Presses • Pneumatic Presses • "Hy-Power" Hydraulics • Air Control Valves

Now, a complete new 20-page catalog for the Waldes Truarc Grooving Tool

• • • the One Versatile Tool Designed for High Speed, Precision Cutting of Internal Grooves in Housings and Bores

Here is the most complete catalog ever published — on the cutting of internal concentric recesses. Complete with descriptive, illustrated information and data charts showing how the Waldes Truarc Grooving Tool can solve virtually every internal grooving problem you may have. Shows how even *unskilled labor* can perform precise, production-line operations.

Facts and figures on the Waldes Truarc Grooving Tool . . . its special features, modifications and adaptations.

Data showing how the Waldes Grooving Tool cuts accurate grooves in housings with diameters from .250 to 5.000 inches.

Charts describing various cutters: single, multiple, beveled and special profiles. Description of bottom adaptors, elongated spindles, and extended bushings . . . for solving particular problems.

Location of grooves under varying conditions: in bores, housings, and blind holes.

Diagrams and easy-to-follow instructions on the set-up of the Grooving Tool.

5 full pages showing 17 case histories covering the range of typical problems and solutions.

Complete information on how to select the right model tool . . . and the right accessories . . . for your particular job.

WRITE *NOW* FOR THIS NEW 20-PAGE CATALOG

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TRUARC
REG. U. S. PAT. OFF.
GROOVING TOOL

MADE BY THE MANUFACTURERS OF WALDES TRUARC RETAINING RINGS.

WALDES KOHINOOR, INC., 47-16 Austel Place, Long Island City 1, N. Y.

Waldes Truarc Grooving Tool manufactured under U. S. Pat. 2,411,426

TE-003

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RINDING WHEELS PROVIDE NIFORMITY" ALWAYS!

And - "specification-uniformity" means identical job accuracy everytime . . . faster, better grinding on your hard-to-solve cylindrical problems.

Every Sterling Cylindrical Grinding Wheel has an unusual formula preciseness built into it because of a sustained, penetrating research and development program. Sterling new vitrified bonds are the reason for this new efficiency in specification-duplication which means you can reorder Sterling's "Wheels of Industry" with full confidence in their ability to continue to do faster, better quality work on your repetitive cylindrical jobs.

The ability of Sterling Cylindrical Grinding Wheels to hold their shape is indicative of their high quality. The new vitrified bonds retain the abrasive grains in the wheel structure until all their sharpness has been used in grinding. Little dressing is necessary, even by unskilled operators! While these wheels are created to meet the demands of specific jobs, in an emergency they can "fill in" and provide superior performance on many assignments.

What are your cylindrical grinding problems? A Sterling engineer will gladly solve them with these new, extra-value abrasive units. Decide today . . . right now . . . to have a test made in your own department of a tailormade Sterling Cylindrical Grinding Wheel. Pick your most difficult job! You will be pleased at the results.

BEST IN THE TEST --- THAT'S STERLING

The manufacturer in whose plant this test was conducted wanted Sterling to develop a grinding wheel that would both rough grind the forging and then finish grind the hardened piece. Previous to this, two wheels were being used to do these two grinding operations. The Sterling wheel, size 24 x 3 x 12, specification ZA46 J9 V3, did a remarkable job on both rough and finish grinding, accomplishing in the one abrasive unit what it had taken two other wheels to do! In addition, the Sterling wheel provided faster stock removal and gave better finish!

The unusual efficiency of the Sterling wheel suggests a similar application of Sterling's Cylindrical Grinding Wheels to your own problems. Our engineers will be glad to cooperate in determining the proper grinding wheels for your use.

Ask for These STERLING Research and Development Folders - - -

The modern desire for closer study of up to date grinding methods makes these folders especially important. They form a handy file to supplement the advice of Sterling's engineers, giving many suggestions for proper wheels to use on a wide variety of operations. The popular fifth edition of the well known "Art and Science of Grinding" is included in the material which will be sent upon request. Simply write us on your company letterhead and we will mail them at once.

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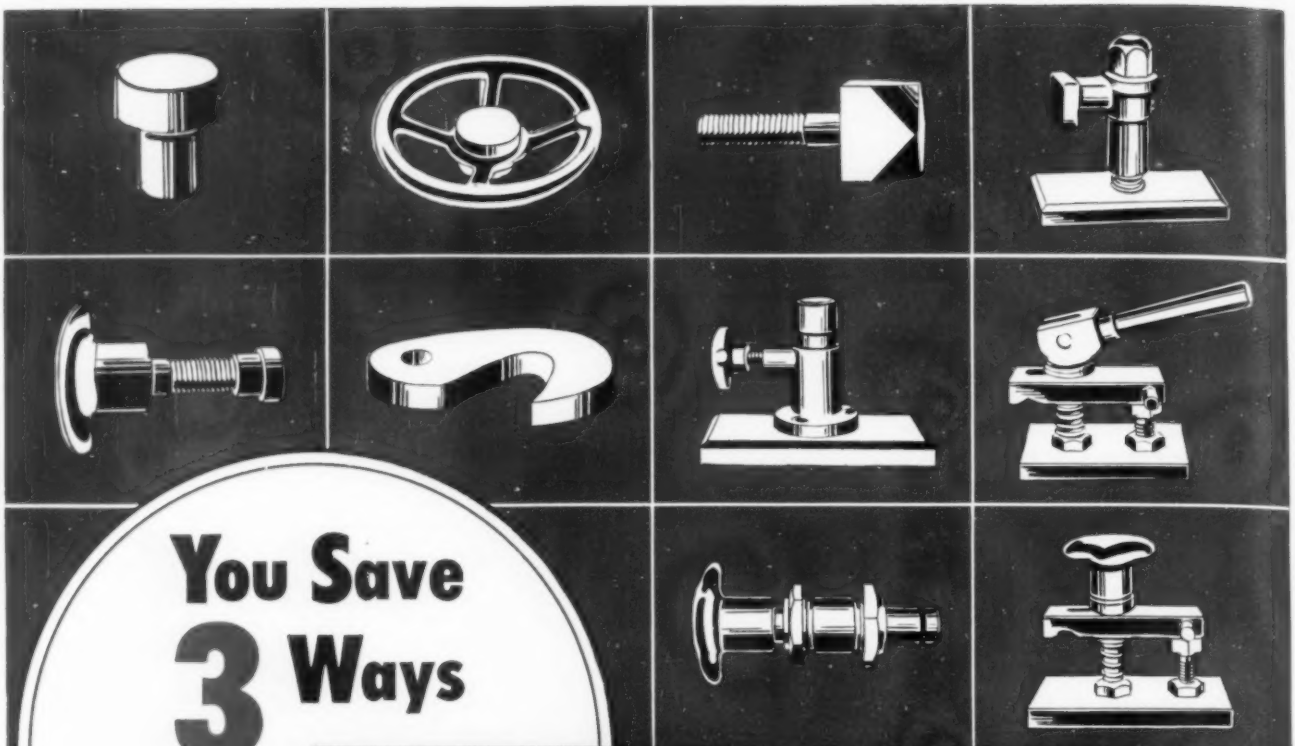

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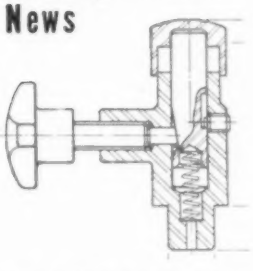
1. Save at Engineering Level!

2. Save Tool Room Labor!

3. Save with Lodding Quality!

Lodding Fixture News



New Lodding Spring Jack records major savings. Ask for design details!

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THE STANDARD LINE OF JIG AND FIXTURE COMPONENTS

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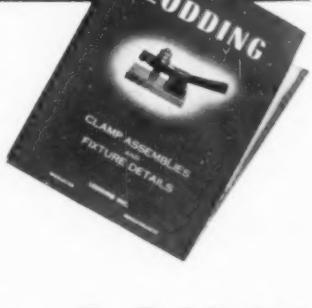
Contains full scale lay-outs of fixture details and clamp assemblies.



Consider these 3 OUTSTANDING Advantages of SPRINGFIELD VERTICAL GRINDERS

ALL SLIDEWAYS ABOVE GRINDING WHEEL

protected from abrasive dust and grit . . . LONGER LIFE.

NO GRAVITATIONAL PULL

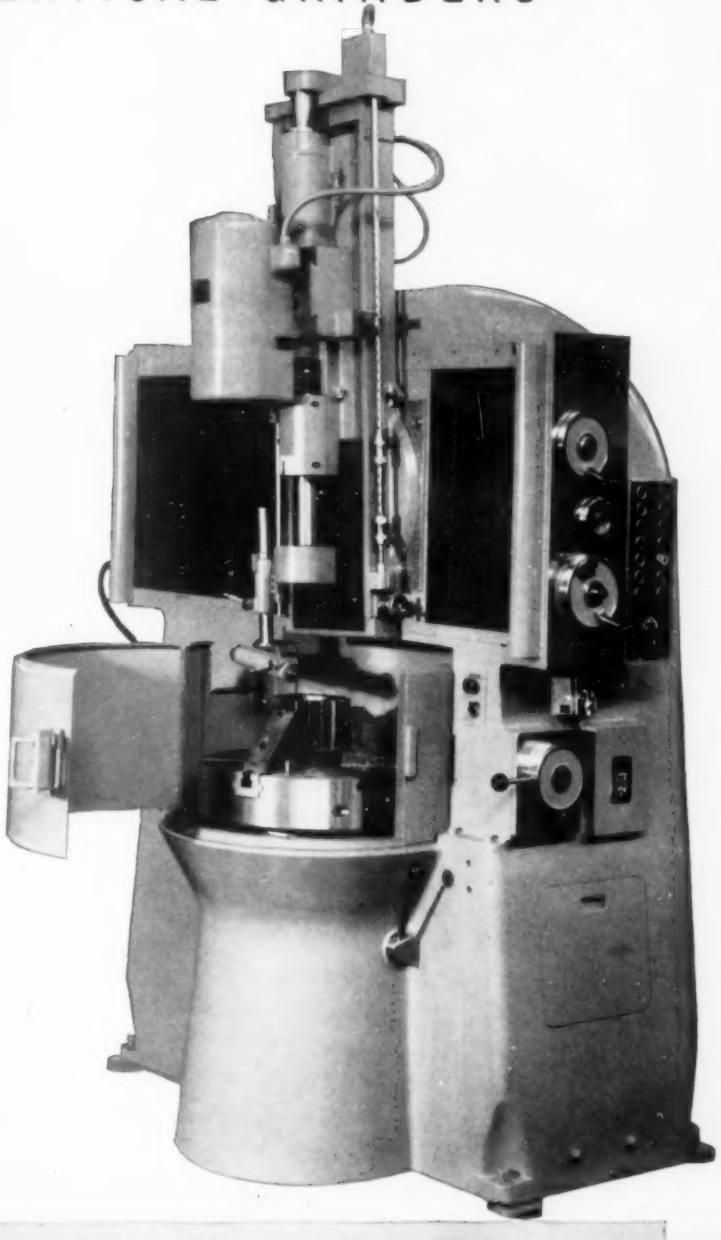
to throw work out of line. Work sets solidly on vertical spindle . . . GREATER ACCURACY.

EASE OF OPERATION

All controls conveniently located at normal height; greater work visibility; easier loading . . . HIGHER PRODUCTION.

PLUS the added advantage of GREATER VERSATILITY

Grind combinations of O.D., I.D., faces, tapers, shoulders or steps with one set-up. Hold extremely close related tolerances.



Springfield Vertical Grinders are thoroughly proved by 14 years of time-saving, cost-saving precision production. Various capacities to 42" swing x 24" hole depth.

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SPRINGFIELD, OHIO, U. S. A.

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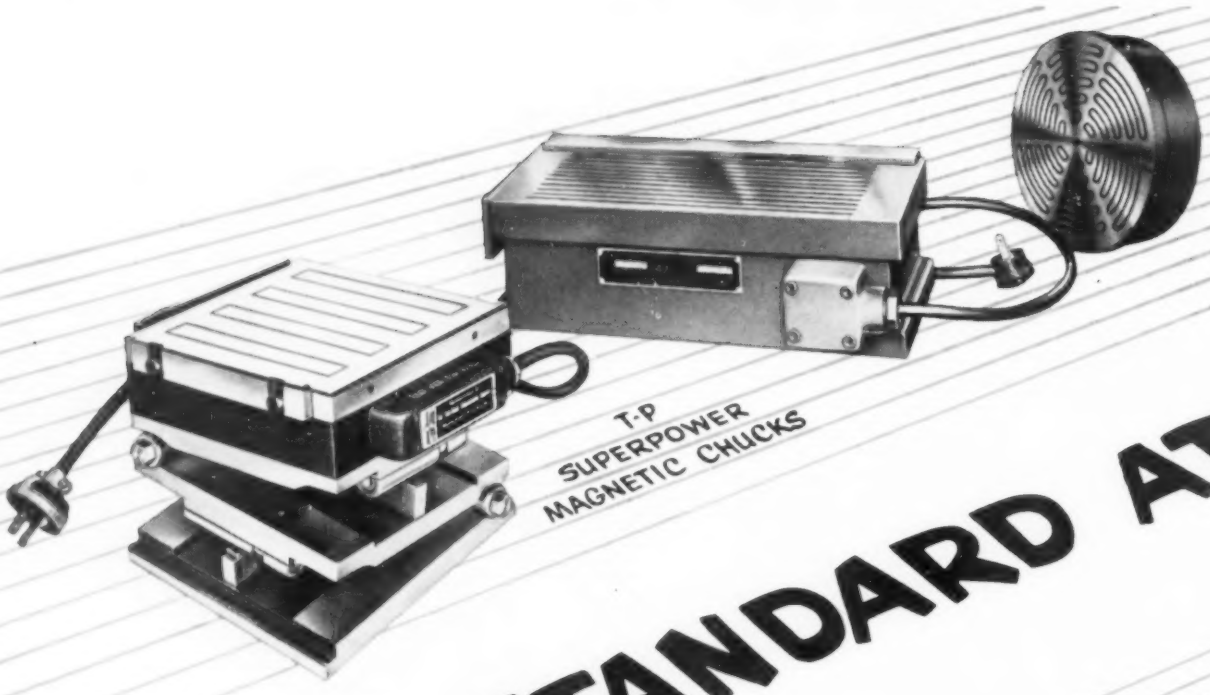


T-P
SUPERPOWER
MAGNETIC CHUCKS

THIS IS STANDARD AT

T-P MACHINE TOOLS

T-P COMPAIRATOR

Production and Inspection Tools

TAFT - PEIRCE

That Speed Precision Work —

Chances are you're already using many items from some of these Taft-Peirce product lines. You should know them all. Each has certain exclusive advantages that set it apart from competitive products. Many of them are actually not competitive at all — since in their own specific field of application nothing else compares. For example:

T-P Superpower Magnetic Chucks pack more power in less space.

T-P #1 Surface Grinders and Lapping Machines easily produce surfaces with an accuracy, flatness, and finish previously considered difficult or impossible.

T-P CompAIRator measures a wider range and variety of work than any other air gage. The COMPUTING CompAIRator also solves simple problems, and indicates the result on the dial-face.

T-P Rotochek, a valuable adjunct to the T-P line of fixed gages, is the fastest thread gaging method ever devised. Push — and the gage enters the work. Pull — and it disengages.

T-P Tool Room Equipment includes many special time-and-labor-saving items such as taper testing fixtures and adjustable angle plates to mention only two.

Each of these products is part of a complete Taft-Peirce line. Available in standard or special models tailored to your needs. Full details are described in the new Taft-Peirce Handbook. Write for your copy today.

T-P

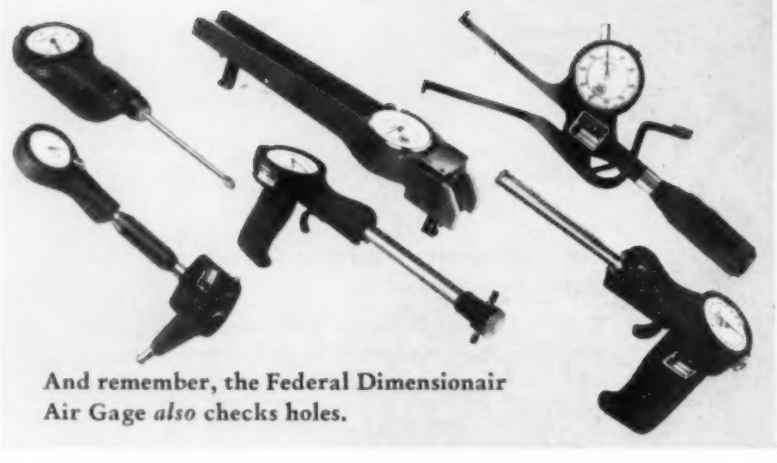
T-P means Top Precision

THE TAFT-PEIRCE MANUFACTURING COMPANY • WOONSOCKET, RHODE ISLAND

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-6-237

WHETHER A HOLE IS DEEP OR SHALLOW, narrow or wide, whether it's difficult to get at, recessed or irregular there's a Federal Indicating Gage to check it conveniently, and to precisely the dimension limits you require. With a Federal Gage you can inspect a hole as small as .122" and as large as — well, you tell us how big!

Each of the gages below is built to fit certain gaging limitations better than any other gage. Find how useful they can be to you by writing for information on a hole gage to do your special job. Federal Products Corporation, Providence 1, R. I.



And remember, the Federal Dimensionair Air Gage *also* checks holes.

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Please send me information on a hole gage for the following job:

☐ Sketch ☐ Blueprint is enclosed showing dimension we wish to gage.

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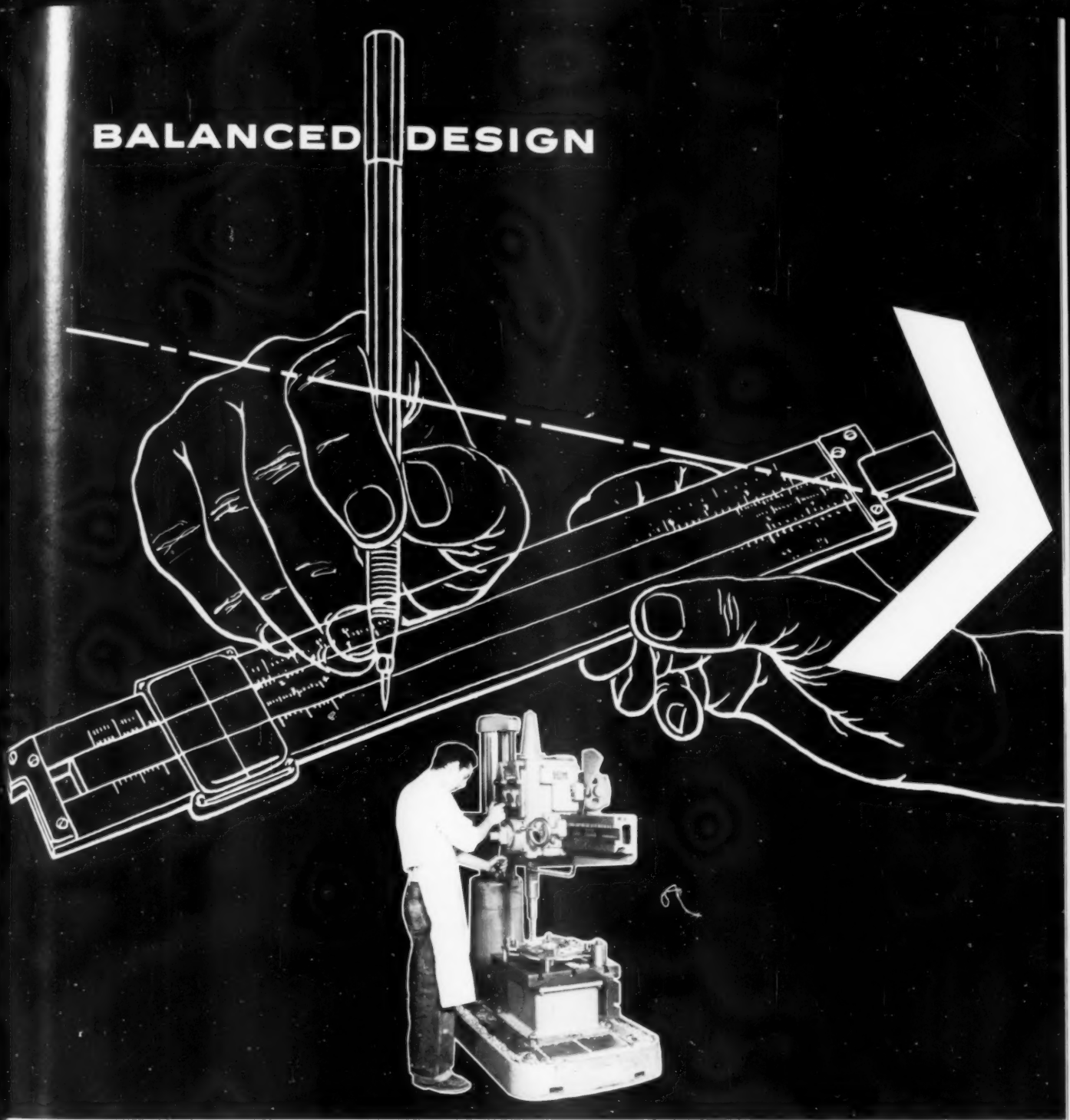
Company .....

Street .....

City ..... *State* .....



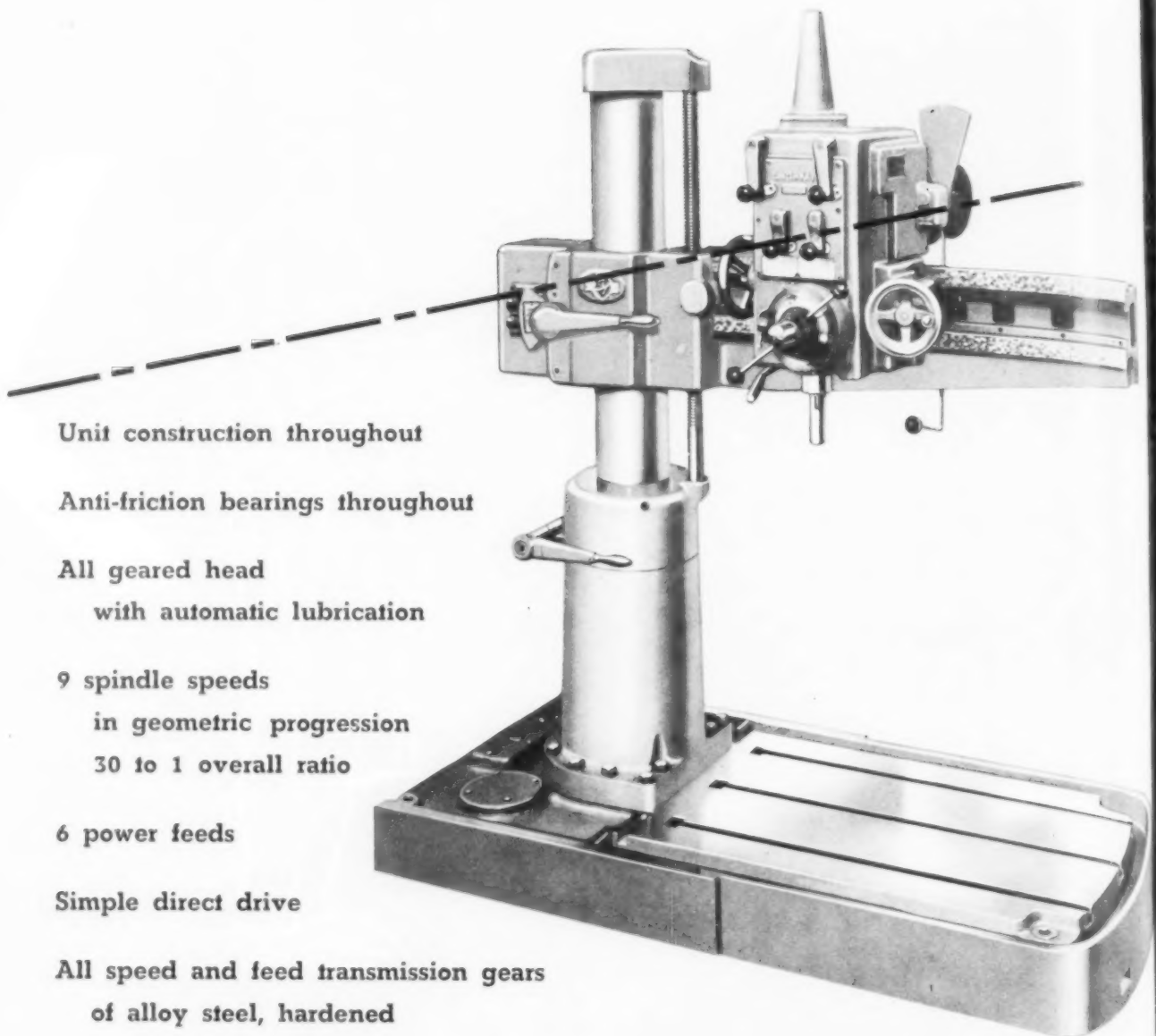
We're getting reports from all over the country on how operators really like the new 3' Arm 7" Column Radial Cintidrill. The smooth way it "handles" . . . the wide range of jobs within its 1-inch capacity . . . its round-the-clock reliability – can all be summed up as BALANCED DESIGN. It'll be worth a check right soon on how this new economy-priced radial can smooth out drilling schedules and save money for you.

best buys in their class!

CINTI

CINCINNATI LATHE & TOOL CO., CINCINNATI 9, OHIO, U. S. A.

MORE **QUALITY** FEATURES



Unit construction throughout

Anti-friction bearings throughout

All geared head
with automatic lubrication

9 spindle speeds
in geometric progression
30 to 1 overall ratio

6 power feeds

Simple direct drive

All speed and feed transmission gears
of alloy steel, hardened

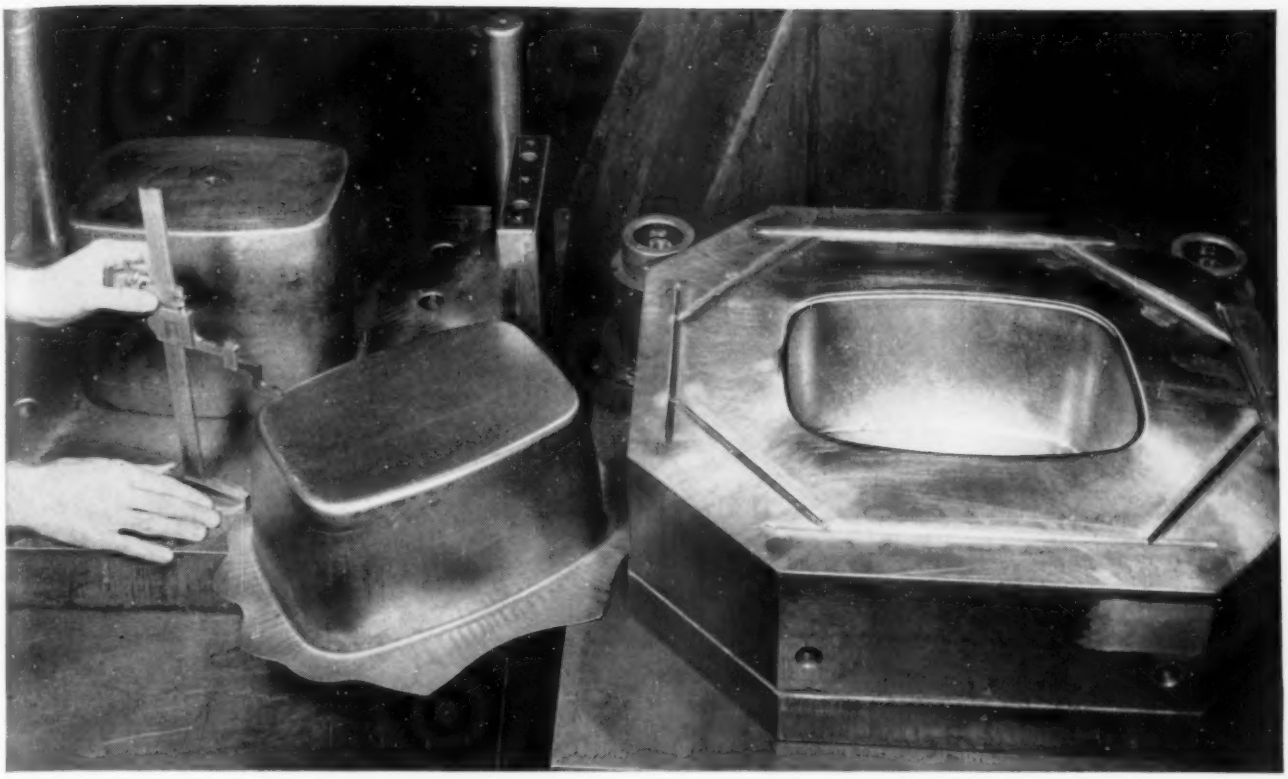
This cost-saving radial is just one of the complete balanced line of Cintidrills, including 21″ sliding head box and round column floor drills; 14″ 3000 and 16″ 3000 sliding head bench and floor drills; 16″ and 18″ Royal Cintidrills, bench and floor models, single and multiple spindles. Write for catalogs and name of your nearest dealer.

best buys in their class!

CINTI DRILL

CINCINNATI LATHE & TOOL CO., CINCINNATI 9, OHIO, U. S. A.

Graph-Mo® steel die draws contour shell 5⅞" deep without scoring!



TO keep production up and finishing costs down when deep drawing contour shells for home fryers, the Dickey Grabler Company, Cleveland, Ohio, uses dies made of Graph-Mo®—one of four Timken® graphitic tool steels.

Because of the free graphite in its structure, Graph-Mo has outstanding low-friction properties: minimum tendency to score, seize, scuff or gall. As a result, Graph-Mo dies make the difficult 5⅞" deep contour draw without scoring the stamping. Costly polishing before the chrome-plating operation is eliminated, die life increased.

Graph-Mo offers other die advantages, too. The diamond-hard carbides in Graph-Mo give excellent resistance to wear and abrasion. It responds uniformly to heat-treatment, permitting closer tolerances in the parts. It has good stability, and is easier to machine than ordinary tool steels.

For more helpful information on the four Timken graphitic tool steels and their uses in dies, punches, gages and machine parts, write for the 10th edition of "Timken Graphitic Steel Data Book". The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

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LATROBE . . . the one source that furnishes "DESEGATIZED" high speed tool steels - uniform in quality - free of carbide segregation - whether you buy on mill order or from warehouse stocks . . . the mill where Ultrasonic Reflectoscope inspection is a part of standard manufacturing procedure to assure the internal soundness of the tool steel you buy . . . the only producer to offer disc inspection service to all tool steel users as your guarantee of the top quality you get on every order.

The fine moly-type high speed tool steel brands indicated here are available to meet your requirements for quality materials. Tougher than the comparable tungsten types at equivalent hardness, they have found wide-spread acceptance among the users of high speed steels.

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LATROBE STEEL COMPANY

Latrobe, Pennsylvania

Sole Producers of "DESEGATIZED" Steels

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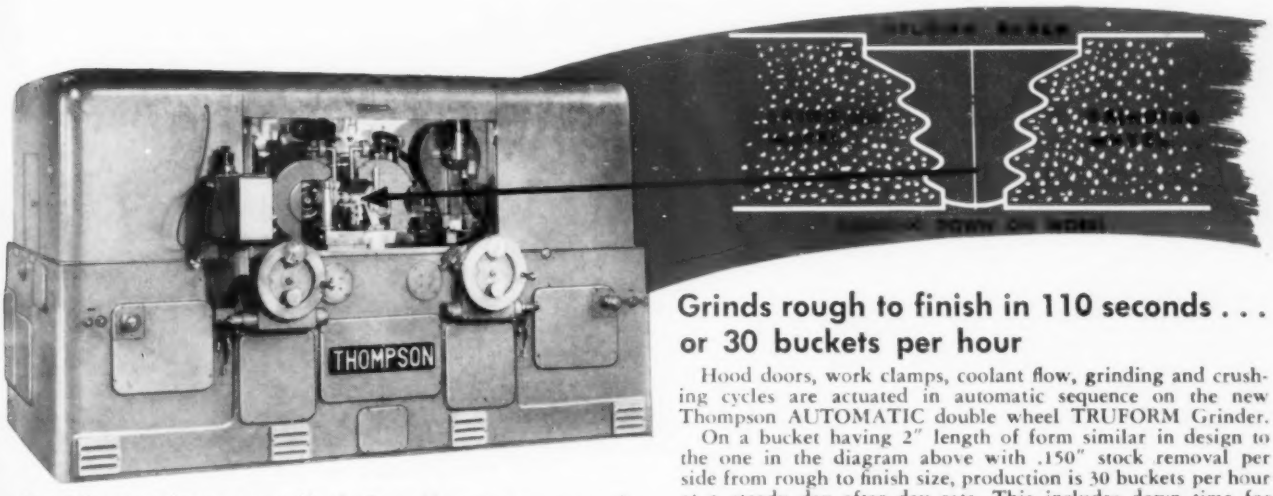
New Thompson AUTOMATIC double wheel TRUFORM Grinder speeds jet engine production

GRINDS BOTH SIDES OF JET TURBINE BUCKETS OR BLADES SIMULTANEOUSLY IN A SINGLE SETTING

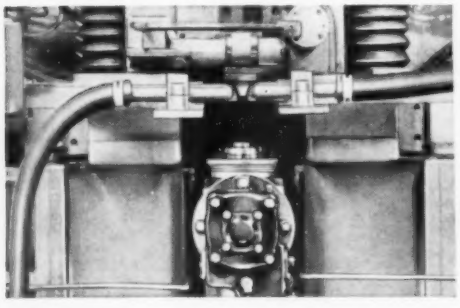


To grind root sections on gas turbine buckets with greatest accuracy and productivity, Thompson developed this new AUTOMATIC double wheel TRUFORMING machine featuring simultaneous grinding of both sides of root section with one setting of work.

Grinds rough to finish in 110 seconds . . . or 30 buckets per hour

Hood doors, work clamps, coolant flow, grinding and crushing cycles are actuated in automatic sequence on the new Thompson AUTOMATIC double wheel TRUFORM Grinder.

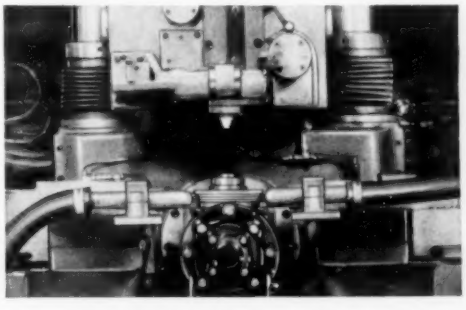
On a bucket having 2" length of form similar in design to the one in the diagram above with .150" stock removal per side from rough to finish size, production is 30 buckets per hour at a steady day after day rate. This includes down time for dressing, regrinding the crusher roll, initial machine warm up period, wheel changing and diamond changing. Actual machine time from rough forging or casting to finish is 104 seconds plus 6 seconds for loading and unloading time . . . makes total time floor to floor 110 seconds per piece.



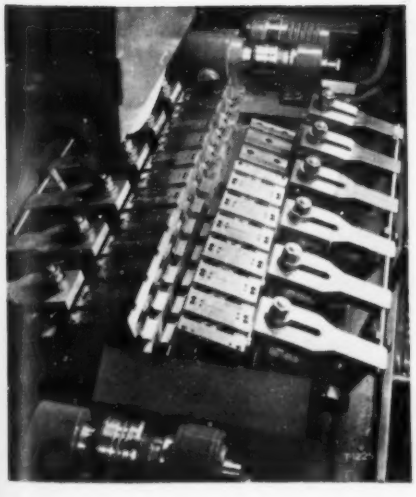
FOR ABSOLUTE SYMMETRY BOTH WHEELS ARE DRESSED FROM A SINGLE CRUSHER ROLL

◀ GRINDING POSITION

CRUSHING POSITION ▶

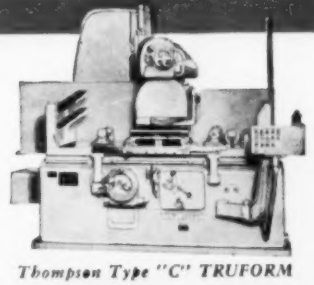


Standard THOMPSON TRUFORM Machines also grind jet buckets faster, better



By means of multiple grinding of jet turbine buckets the standard TRUFORM Grinders still offer high production plus many advantages such as flexibility of standard machine design and lower first cost. Although compared to the new AUTOMATIC the standard TRUFORM requires more skillful set up and tooling.

◀ **Typical tooling on Type "C" TRUFORM producing 24 buckets per hour. Type "B" TRUFORM produces 18 parts per hour.**



Thompson Type "C" TRUFORM

FOR COMPLETE DETAILS WRITE TODAY

The Thompson Grinder Co.

Springfield, Ohio

Thompson SURFACE Grinders

"... Upwards of 80 per cent of all Gulf Oil employees ..."

S. A. SWENSRUD
President, Gulf Oil Corporation

"I have no hesitation in saying I believe it is a sound thing for our industry to support the Government's Payroll Savings Plan and to encourage our employees to put at least a substantial part of their savings into U.S. Savings Bonds. Upwards of 80 per cent of all Gulf Oil employees save part of each pay in E Bonds. This type of thrift is good for the nation as well as for the individual."

At the close of 1952–

- Individual Americans owned Savings Bonds totaling more than $49 billion, cash value.
- Series E Bonds outstanding—the kind bought by Payroll Savers—were more than $600 million greater than on May 1, 1951, when the bonds issued in 1941 started to mature.
- Of the $4.8 billion Series E Bonds which matured between May, 1951, and December, 1952, more than $3.6 billion (75%) were held beyond maturity, under the automatic extension plan.
- More than 77 million units of Series E Savings Bonds were bought by individuals in 1952–13% more than in the previous year.
- During every one of the past 21 months, redemptions of unmatured Series E Bonds have been well under 1% of the total amount outstanding.
- 1953 figures should be even better—more than 1,000,000 Americans joined the Payroll Savings Plan in 1952, and thousands, literally, are enrolling every day.
- Never before in the history of this or any other country have employed men and women held a reserve purchasing power of $49 billion in government securities—a cushion against emergency, a check on inflationary tendencies.

If you believe with Mr. Swensrud that "it is a sound thing for industry to support the Payroll Savings Plan . . ." and ". . . this type of thrift is good for the nation as well as the individual," phone, wire or write to Savings Bond Division, U. S. Treasury Department, Washington, D. C. Your State Director will show you how your participation can be raised to 60%, 70% or even higher.

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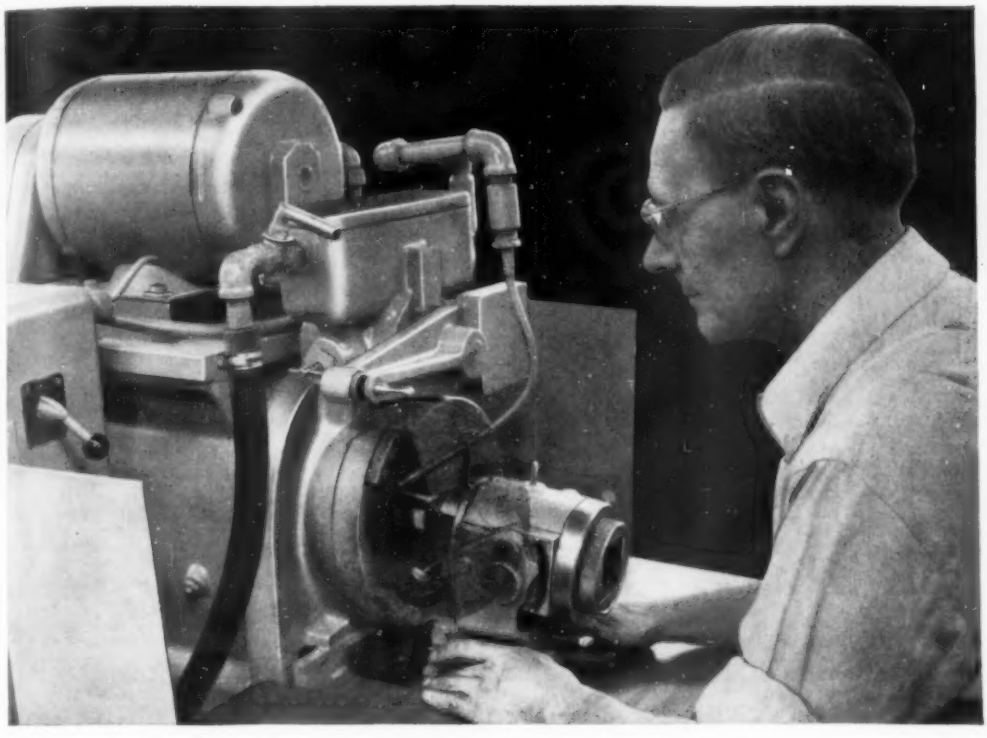
BURA-WAY...with the

"TOUCH OF GOLD"



BURA-WAY does it better. This Norton Tool Grinder for convex single point and form tools: (1) generates, reproduces and maintains relief angles *constant in the direction of feed,* providing uniform support to the cutting edge and; (2) insures exact duplicates of the master tool form.

Here's longer life for your carbide-tipped tools with the Norton No. 2 BURA-WAY Tool Grinder

Your operator gives you the "Touch of Gold!"

When he's sharpening your carbide-tipped tools on the Norton No. 2 BURA-WAY he is adding longer life value to the tools, helping you to make more profit and turn out better products for your customers. Every time the wheel touches the tool, it adds the product-improving, cost-cutting "Touch of Gold."

Precise Duplicates Every Time

In the BURA-WAY No. 2 you have the ideal tool grinder. The BURA-WAY method increases tool life and gives you more pieces per sharpening. By exact duplication of the master tool, tremendous additional benefits may be realized from an effective tool control system and reduced set up time when changing tools.

Find Out More

Get in touch with your Norton representative whose knowledge and experience is further supplemented by Norton trained engineers. Only Norton offers you such long experience in both grinding machines and wheels to help you produce more at lower cost. Write NORTON COMPANY, Machine Division, Worcester 6, Mass.

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YEARS of broad experience in forgings for almost every conceivable tool, die and stainless steel application have fitted our Forge Plants to deal expertly with any requirements you may have in this exacting field.

Regardless of the shape or material involved, we are equipped to furnish correctly made forgings that will give you the utmost in effective performance.

Any Allegheny Ludlum field representative can give you further particulars. Let us quote on your regular requirements or special problems—either on forgings "as is", rough machined, or finish machined to specifications.

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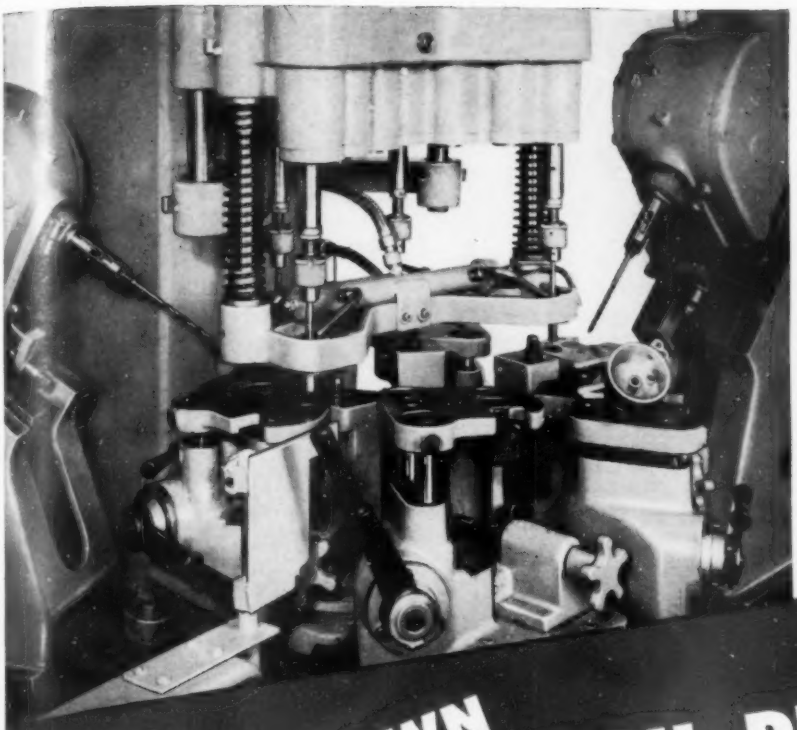
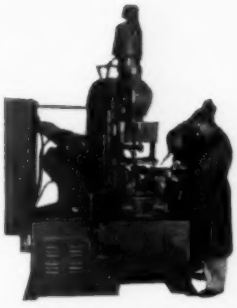
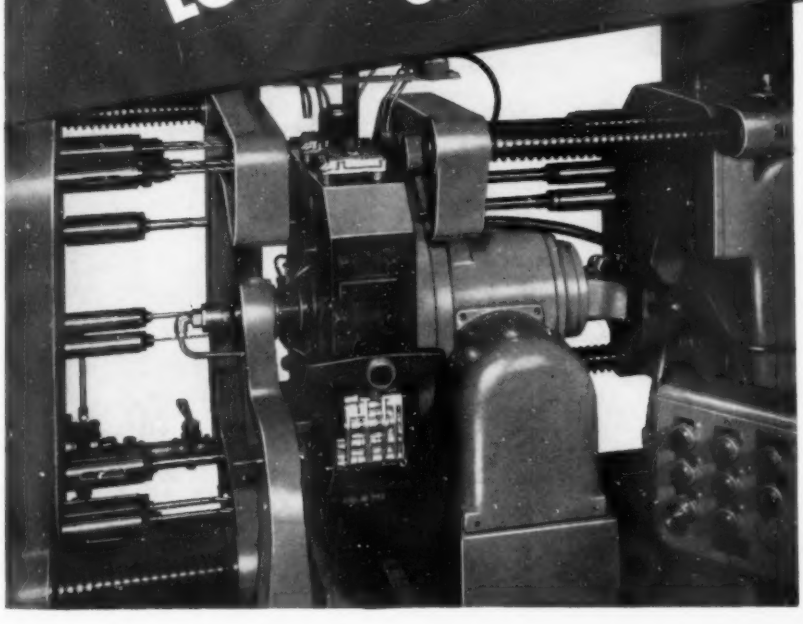
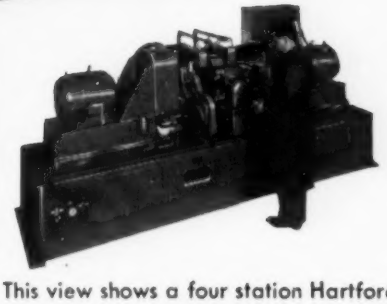




Closeup at the left shows a six station Hartford Automatic single purpose machine rough and finish reaming two cored holes, plus drilling two holes at different angles in die cast aluminum housings.

The LOWDOWN on HIGH PRODUCTION





This view shows a four station Hartford vertical dial type machine drilling, coredrilling and counterboring five holes in aluminum valve bodies.

Hartford Special is ready to design and build a special purpose drilling and tapping machine to boost your production, too. Why not write for more information.

When it comes to production — come to

HARTFORD *Special*

... the best buy in the long run

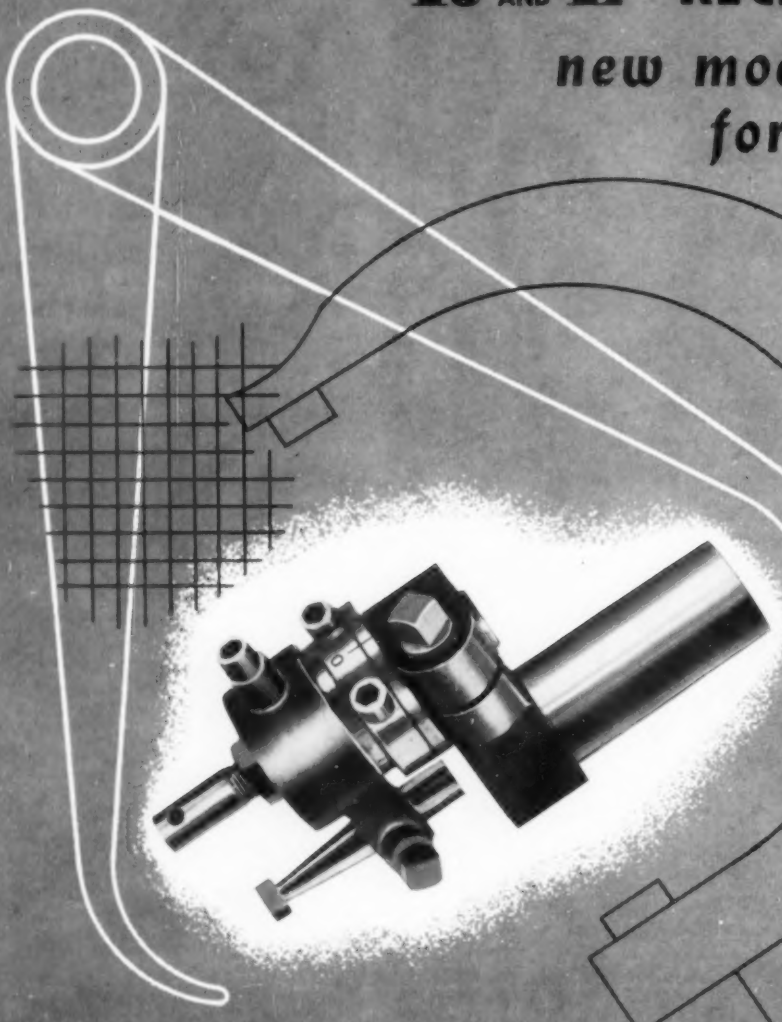
SUPER-SPACERS

Automatic THREAD ROLLERS

THE HARTFORD SPECIAL MACHINERY CO., HARTFORD 12, CONN.

R AND L RECESSING TOOL

new modern design for easy operation



This Recessing Tool adjusts to operate on any internal diameter within its capacity. Adjustable for operations on outside diameters for cutting grooves, chamfering, or cutting clearance at the end of threads. Easily adjusted to operate on a right or left handed spindle with downward pressure on the cutter giving steadier action.

SIZE	LENGTH OF SHANK	DIAMETER OF SHANK	LENGTH OF BODY	PRICE
No. 00	1 3/8"	5/8"	1 1/4"	$ 73.50
No. 1	1 7/8"	3/4"	1 3/4"	$ 87.50
No. 2	2"	1"	2 3/4"	$100.00

Write for complete catalog

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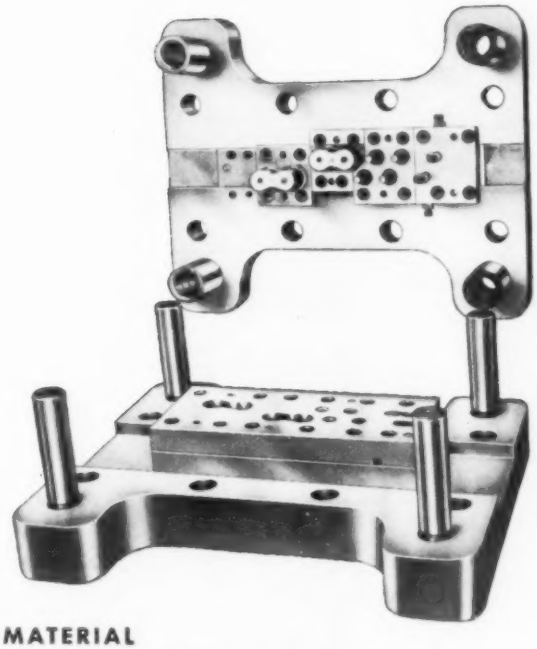
WHITNEY CHAIN

links up with... PRODUCTO

DIE SETS



MATERIAL

¼" SAE 3140 hot rolled steel in coiled stock.

OPERATIONS

Station No. 1 — Whitney Chain markings clearly embossed on each link.

Station No. 2 — Four holes, two to a link, rough pierced.

Station No. 3 — Two chain links blanked out on each press stroke.

TOLERANCES

Hole diameter + .0005" — .0005"
Hole centers + .001" — .001"
Link Contour + .005" — .010"
Die Set face parallel to feed slot + .002" — .002"

PRODUCTION RATE

153,000 links blanked per 40 hour week.
Between grinds, 75,000 pieces.

**NEED PROMPT SERVICE?
CALL YOUR NEAREST
PRODUCTO ASSEMBLY BRANCH**

Tough, ¼ inch-thick hot rolled steel chain links are not an easy stamping job . . . especially when heavy production must be matched with close tolerances and excellent finish.

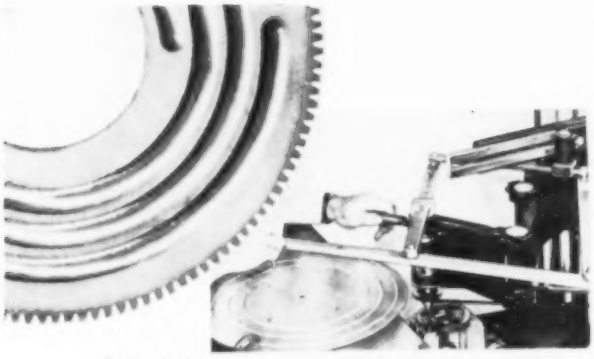
Here are the figures as this job rolls along at Whitney Chain on Niagara presses equipped with PRODUCTO 4-pin progressive die sets. It's typical of the way Producto Service teams up to set production records.

THE PRODUCTO MACHINE COMPANY
930 Housatonic Ave., Bridgeport 1, Connecticut
3PD52A

For Precision Die Sets *Fast* Call . . .

PRODUCTO

ALSO MAKERS OF TOOL AND DIEMAKERS ACCESSORIES, VISES, MACHINERY



PANTOGRAPHIC

MILLING OF SPIRALS

ON METALS AND PLASTICS

Rapidly done by unskilled labor

with NEW HERMES Engravo graph

Write for Literature
Catalog H63 Bench Type Model (weight 200 lbs.)
Portable Model 1M also available

Production: 6" brass spiral with 1/4" x 1/4" groove cut from 3 times larger template Time: 12 units per hour.

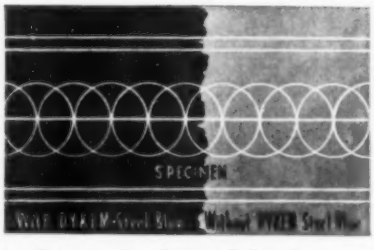
NEW HERMES, INC. 13-19 University Place, N. Y. 3
Representatives in all principal cities. Canada—359 St. James St., Montreal

USE READER SERVICE CARD; INDICATE A-6-252-1

DYKEM STEEL BLUE

STOPS LOSSES

making dies & templates



Simply brush on right at the bench; ready for the layout in a few minutes. The dark blue background makes the scribed layout show up in sharp relief and at the same time prevents metal glare. Increases efficiency and accuracy.

Write for full information

THE DYKEM COMPANY, 2303D North 11th St., St. Louis 6, Mo.

USE READER SERVICE CARD; INDICATE A-6-252-2

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CUT DESIGN AND TOOLROOM COSTS

SAVE 1/3 OR MORE ON JIG and FIXTURE PARTS

BLANK JAWS
SINE FIXTURE KEYS
SHOULDER SCREWS
MALLEABLE HANDLES
TEE SLOT BOLTS
THUMB SCREWS
TEE SLOT NUTS
HAND WHEELS
REST BUTTONS
FIXTURE KEYS
HAND KNOBS
C-WASHERS
STUDS, ETC.

SPECIFY THE LINE THAT SAVES YOU TIME!

Use Jergens mass-produced components as standard in your plant. Realize big savings in design, tool room and production facilities. Jergens makes over 400 precision parts designed to save your time and money—standards that will hold up in the toughest applications usually outlasting the jigs and fixtures on which they are used.

WRITE FOR YOUR COPY OF JERGENS' NEW FOLDER

Jergens BETTER TOOLS AT LOWER COST

TOOL SPECIALTY CO.
Dept. TE 712 E. 163rd St.
Cleveland 10, Ohio

USE READER SERVICE CARD; INDICATE A-6-252-3

Buol

HELICAL SPIRAL TAPER PIN REAMER

featuring

Continuous change in lead angle to compensate for continuous change in diameter.

- This feature insures uniform depth of radial undercut (shear) on the entire length of the taper and provides uniform relief at all points on the diameter.
- In stock for immediate delivery sizes #6/0 thru #10. Made promptly to order sizes #11, 12, 13, and 14.
- Backed by 27 years of manufacturing reamers exclusively. We also make Stub Reamers, Die Clearance Reamers, and Special Reamers to your exact specifications.

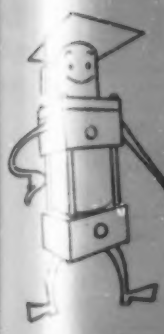
MANUFACTURERS' AGENTS: Exclusive territories open outside of New England and metropolitan New York. Write us.

THE BUOL MACHINE CO.
REAMERS EXCLUSIVELY
PARK & MEADOW NEW BRITAIN, CONN.

USE READER SERVICE CARD; INDICATE A-6-252-4

Miller

FLUID PRESSURE BOOSTERS



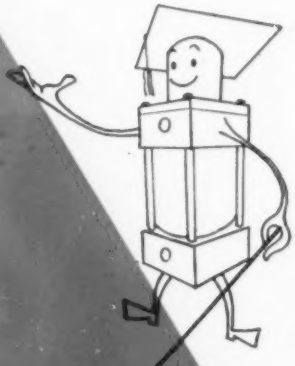
BOOST 80 PSI AIR

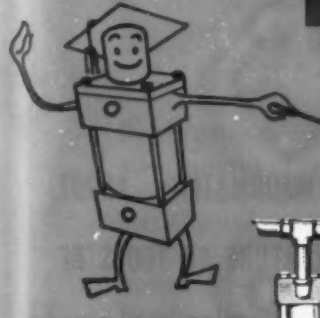
Input Range: 40 to 3000 psi Air or Fluid

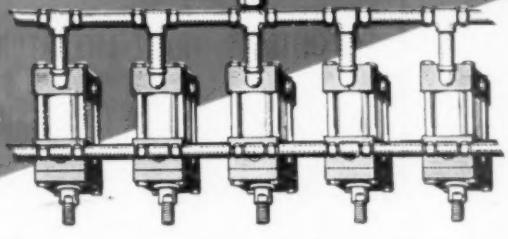
TO 2000 PSI HYDRAULIC PRESSURE

Output Range: 200 to 10,000 psi Fluid

- Save space, weight and investment cost by replacing pump installations in many applications
- Less costly to install, operate and maintain
- **Hold pressure indefinitely** without the motion and heat generation of ordinary pump circuits
- Provide—at point of cylinder thrust—more efficient power with less weight in less space than direct driven air cylinders
- Save up to 95% of air consumed by direct driven air cylinders
- Operate at speeds of 30 to 450 strokes per minute







ESPECIALLY RECOMMENDED FOR

- **WELDING**
- **PUNCHING**
- **SHEARING**
- **CLAMPING**
- **RIVETING**
- **CRIMPING**
- **PRESSING**

and similar applications

FULL DETAILS IN MILLER BULLETIN B-200 SENT FREE ON REQUEST
Other Miller products include: Air cylinders, 1½" to 20" Bores, 200 PSI operation; low pressure hydraulic cylinders, 1½" to 6" bores for 500 PSI operation, 8" to 14" bores for 250 PSI; high pressure hydraulic cylinders, 1½" to 12" bores, 2000-3000 PSI operation. All mounting styles available.

SALES AND SERVICE FROM COAST TO COAST

EVELAND • YOUNGSTOWN • DAYTON • PITTSBURGH • PHILADELPHIA • STON • HARTFORD • NEW YORK CITY • BUFFALO • ST. PAUL • GRAND PIDS • DETROIT • FLINT • FORT WAYNE • SOUTH BEND • INDIANAPOLIS MILWAUKEE • LOUISVILLE • KANSAS CITY • SEATTLE • LOS ANGELES • N FRANCISCO • BALTIMORE • DENVER • ST. LOUIS • MOLINE • CHICAGO HOUSTON • TORONTO, CANADA and OTHER AREAS

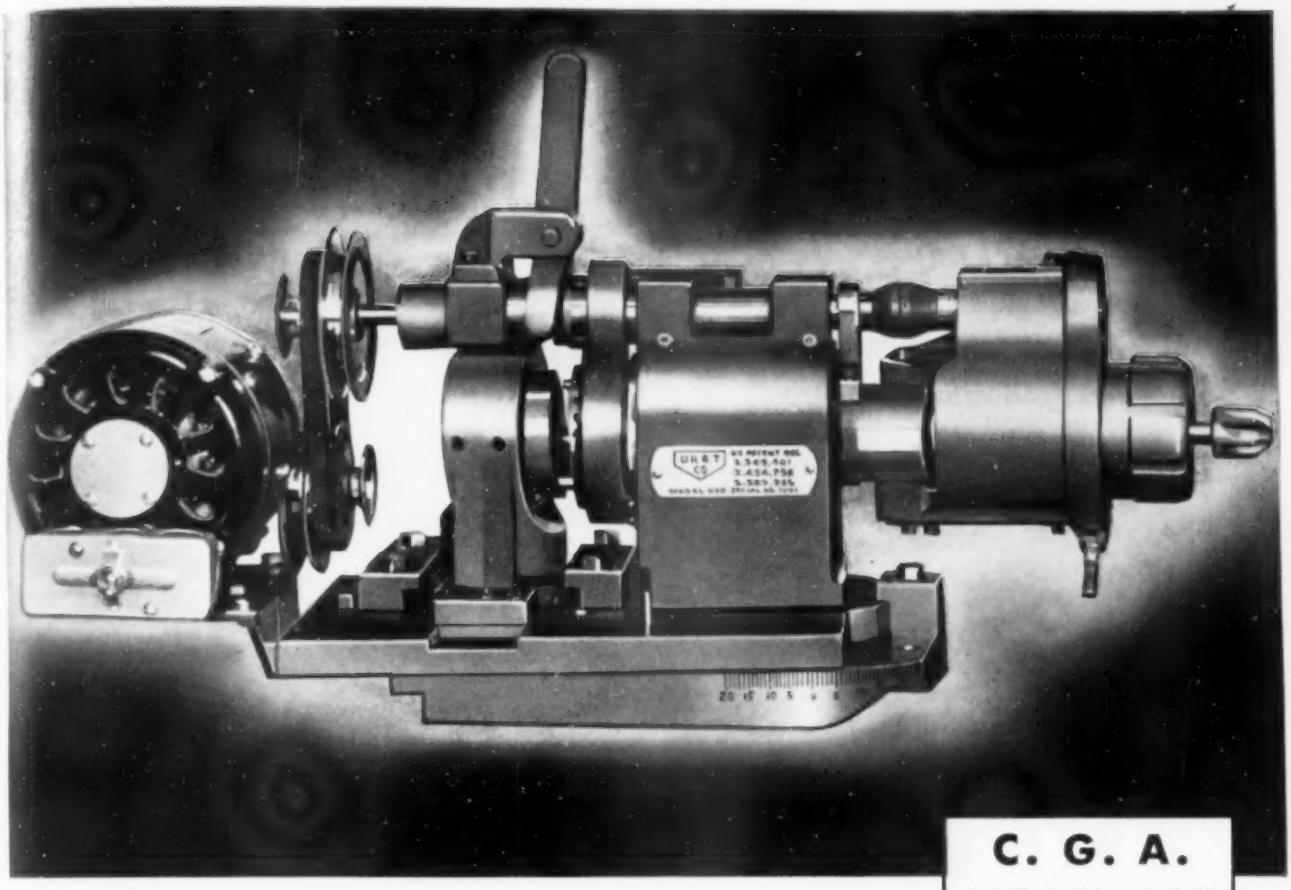
Miller

MILLER MOTOR COMPANY

2010 N. Hawthorne Ave., Melrose Park, Ill.

AIR & HYDRAULIC CYLINDERS • BOOSTERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS

TO OBTAIN FURTHER INFORMATION ABOUT ADVERTISERS, TRADE LITERATURE OR TOOLS OF TODAY APPEARING IN THIS ISSUE OF THE TOOL ENGINEER, USE THE HANDY READERS SERVICE CARD ON PAGE 135.



C. G. A.
MODEL 500

New CIRCULARITY. . . . . GRINDING ATTACHMENT

Detroit Reamer & Tool Company engineers, after months of intensive research and extensive development, have produced in the model 500 Circularity Grinding Attachment a new device that has many outstanding improvements. This new model is faster, easier to handle, has positive control, greater adaptability, rugged construction, and is engineered and precision built to provide the finest in precision work. Therefore, it will be of invaluable assistance to anyone whose tooling standards must meet modern production requirements.

Simple, speedy set-ups on this accurate attachment permit fast and easy grinding of form relief, radial relief, form and radial relief together, tapered cylindrical and straight cylindrical. Cutting tool to be produced or reworked is held in collet or between dead centers and revolves on its own axial center. Where full length of spiral cutting tools is to be ground for both form and radial relief, the Circularity Grinding Attachment travel is similar to an O.D. grinder, which insures fine finish, back taper and accurate size.

DETROIT REAMER & TOOL CO.

2830 E. SEVEN MILE ROAD • DETROIT 34, MICH.

D R & T COMPANY

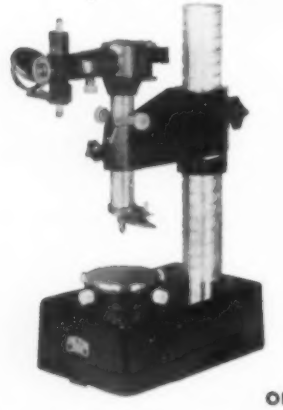
PRECISION INSTRUMENTS

for the Most Exacting Requirements in Modern Tool Engineering and Production

CARL ZEISS JENA

PASSAMETER

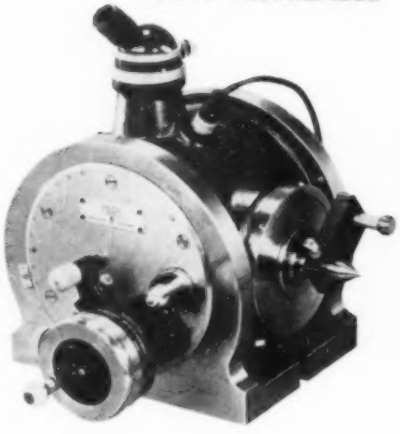
Adjustable indicating snap gauge. Scale reads to .0001 in. Range ± .0035 in. Even pressure constantly maintained.



OPTIMETER

An optical precision indicator for checking dimensions by comparison with a standard gauge. Scale reads to .00005 in.

NOW AVAILABLE



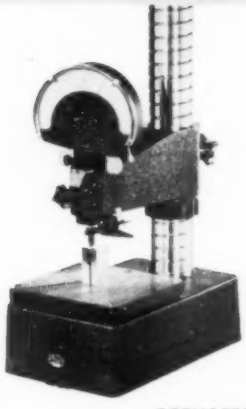
New Model

OPTICAL DIVIDING HEAD

Precision scale reading to 10 sec. of arc. Special presetting device. Sturdy construction—usable on a surface grinder or miller under heavy strain. Reinforced spindle. Precision spindle bearings. Improved microscope for convenient reading in any spindle position.

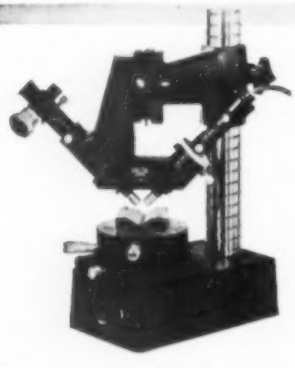
ABBE METROSCOPE

Direct measuring optical instrument. Ultra precision scale and spiral microscope. Measuring range 0 to 200 mm. (0—8 in.) Reads to 1 μ.



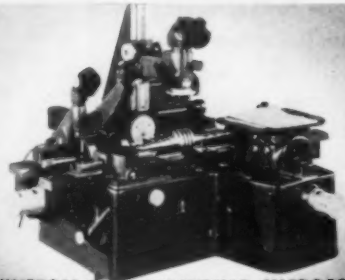
ORTHOTEST

Precision indicating instrument. For checking dimensions by comparison with a standard gauge. Scale reads to .00005 in. Range ± .004 in.



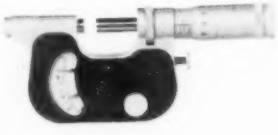
SURFACE FINISH TESTER

Optical slit microscope. For gauging the form, depth and frequency of tool marks on machined surfaces.



UNIVERSAL MEASURING MICROSCOPE

For any and all types of measurements. Ultra precision glass scales with spiral microscopes. Measuring range: main slide, 0 to 200 mm (0 to 8 in.) Cross slide, 0 to 100 mm (0 to 4 in.) Reads to 1 micron.



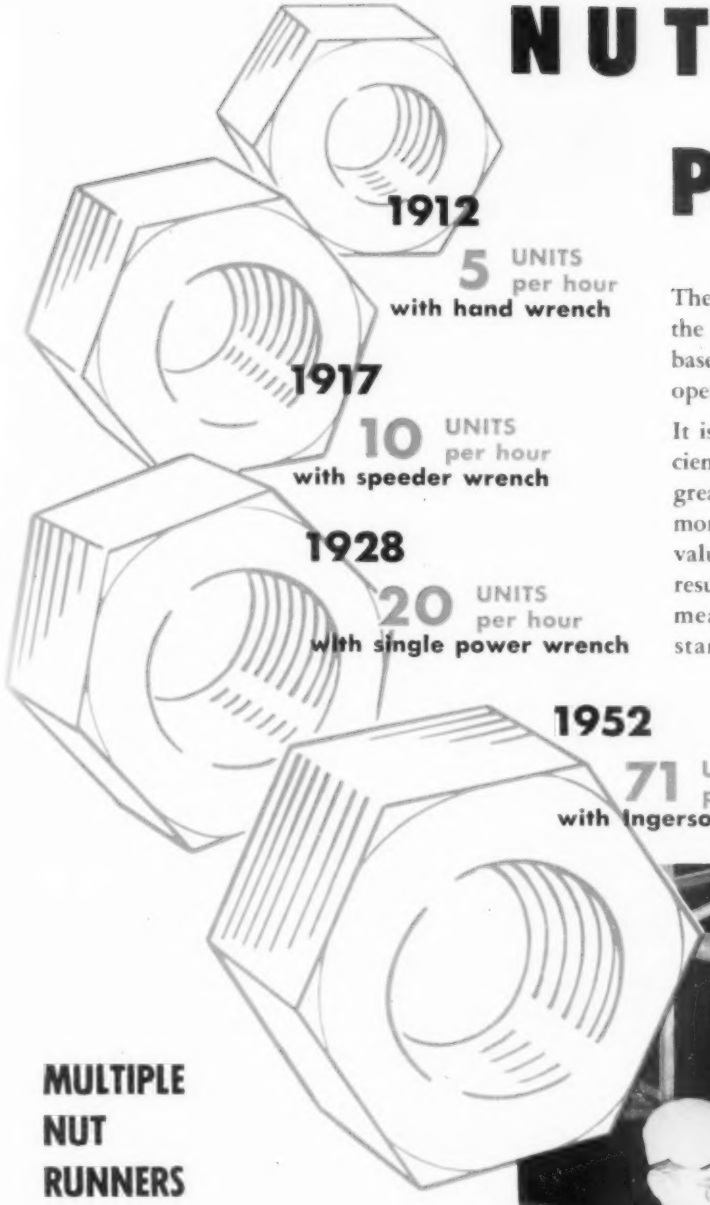
INDICATING MICROMETER

A combination micrometer and indicator enabling direct reading to 0.0001 inch and having advantage over the normal micrometer in excluding errors of "feel"—maintaining constant pressure on the part without the use of a rachet stop.

Exclusive American Representatives for Carl Zeiss, Jena

ERCONA CORP. Scientific Instrument Division **527 Fifth Ave., New York 17, N. Y.**

NUT RUNNING PROGRESS



1912
5 UNITS per hour
with hand wrench

1917
10 UNITS per hour
with speeder wrench

1928
20 UNITS per hour
with single power wrench

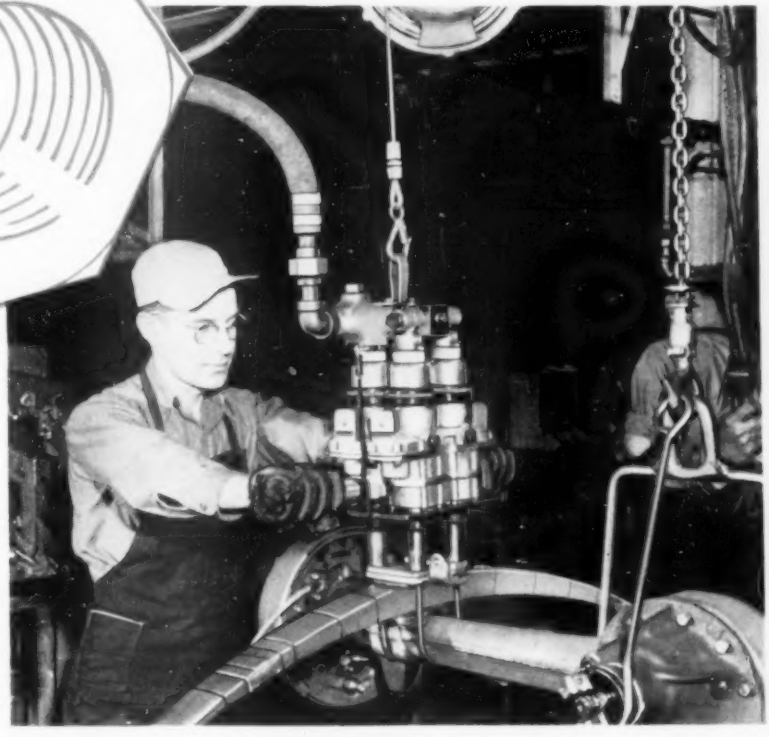
1952
71 UNITS per hour
with Ingersoll-Rand Multiple Nut Runner

The production progress shown at the left is from the records of a leading car manufacturer and was based upon 1000 units of comparable nut running operations.

It is significant that each advance in production efficiency has made possible increased wage rates . . . greater production requiring the employment of more men . . . and an improved product of greater value to the user. This steady improvement in tools resulting in increased labor productivity is in large measure responsible for our nations' superior standard of living.

MULTIPLE NUT RUNNERS *give you:*

- 2 or more nuts driven at once . . . in the time formerly required to drive one.
- Good "quality control" . . . Torque is uniform on each and every nut.
- Safe Operation for operator . . . Torque reaction is non-existent.
- Immediate on-the-job operation . . . No special training needed for the operator.
- Low Maintenance . . . Units in service show maintenance savings up to 50%.



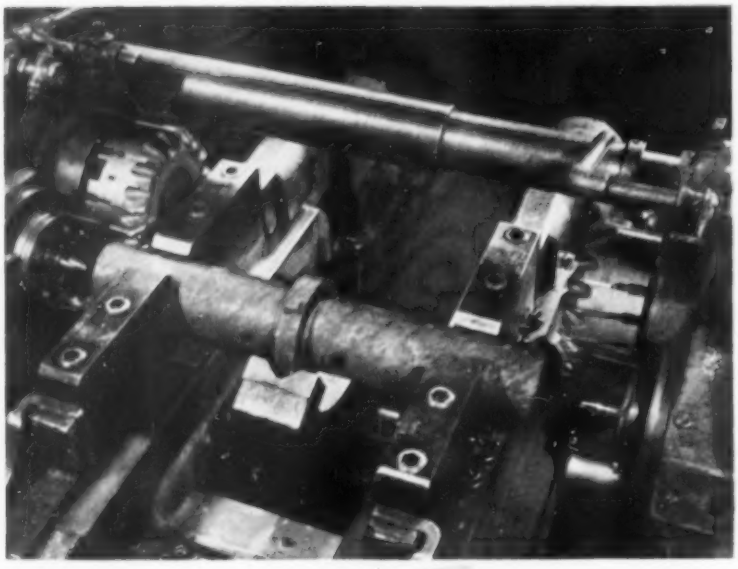
923-8

Ingersoll-Rand
11 Broadway, New York 4, N. Y.

COMPRESSORS • ROCK DRILLS • AIR TOOLS • TURBO BLOWERS • CONDENSERS • CENTRIFUGAL PUMPS • DIESEL AND GAS ENGINES

WESSONMETAL

CORNERSTONE for METAL WORKING PRODUCTION



150% INCREASE IN OUTPUT PER DOLLAR SPENT FOR *WESSON TOOLING*

COMPLETE PRODUCTION STORY ON THE CATERPILLAR TRACK ROLLER SHAFT

Machine	Fay automatic lathe
Part Machined	Track roller shaft
Operation	Milling and centering
Material	1046 steel
Tools	6¾" dia. Wesson Rigidcut Milling Cutter—18 blades
Speed	320 S.F.M.
Depth of Cut	¼" to 7/16"
Feed	15" per min.
Feed per Tooth	.005"
Feed on Center Drill	.006"
Production	400 pcs. per grind; 50 pcs. per hour
Grade of Carbide	Wessonmetal WH

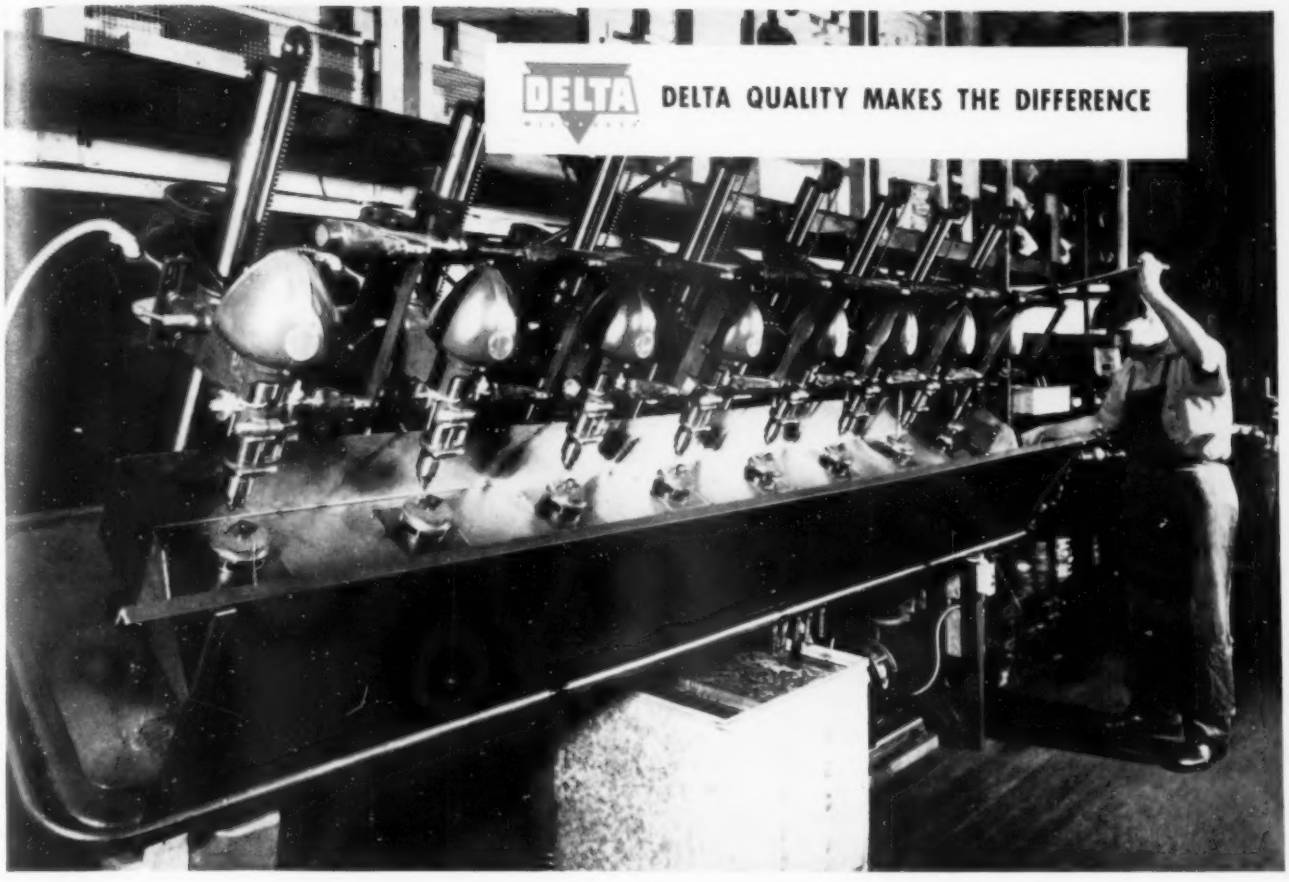
OLD METHOD	WESSON ENGINEERED METHOD
Pieces Per Grind.....166	Pieces Per Grind.....400
Tool Cost Per Piece...$0.0716	Tool Cost Per Piece..$0.0285
Grinding Hours Per Year.....420	Grinding Hours Per Year.....183.33

ON 1 JOB WITH 1 WESSON TOOL SAVINGS OF OVER $2400.00 PER YEAR

WESSON METAL CORPORATION
LEXINGTON, KENTUCKY
Affiliated with WESSON COMPANY, Detroit, Mich.

WESSONMETAL Cemented Carbide

EFFICIENT—LOW COST PRODUCTION



New "slant" on DELTA Drill Presses boosts output at Atlantic Service Co.

Easier cleaning, better lubricant flow, reduced operator fatigue are extra benefits for Brooklyn shop.

A gang set-up of eight Delta 14" Drill Presses mounted at an angle of about 30° and operated by one man, boosted output and made a healthy cut in costs for Atlantic Service Co., Brooklyn, N.Y. This production speeding hook-up was possible because versatile Delta Drill Presses *operate in any position:* upside down, sideways, at any angle.

All spindles in Atlantic's set-up are connected to a master shaft and move simultaneously. Parts to be drilled are held on adjustable jigs. As many as 100 holes are drilled in each piece.

The tilted table is easy to keep clean, improves lubricant flow, makes the operator's job much easier—all of which contribute to a competitively low production cost.

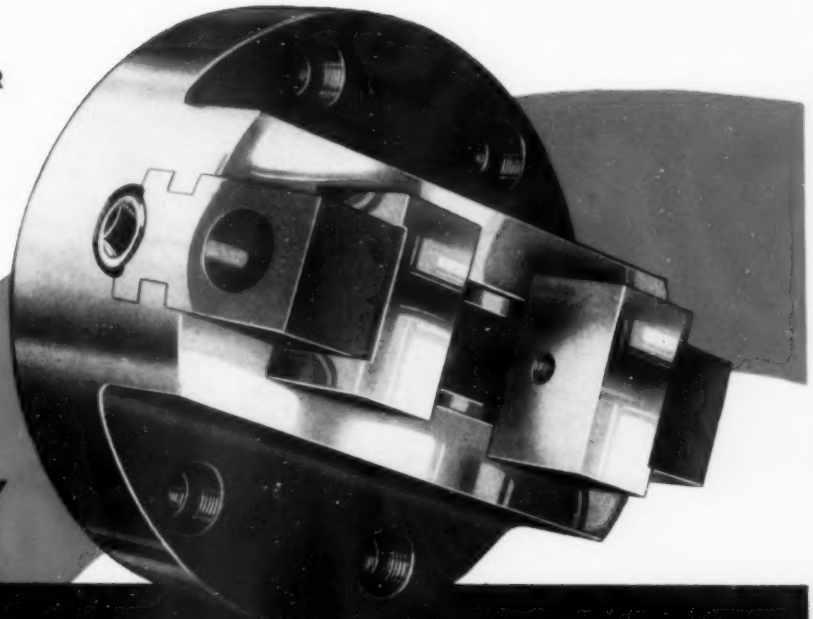
Why not work out your own money-saving slant . . . as thousands of resourceful shop men are doing? Your Delta dealer can help you—he's listed in your Classified Telephone Directory under "Machinery" or "Tools". Write for the latest Delta catalog. Delta Power Tool Division, Rockwell Manufacturing Co., 620-F N. Lexington Avenue, Pittsburgh 8, Pa.

DELTA QUALITY POWER TOOLS

Another Product by **Rockwell**

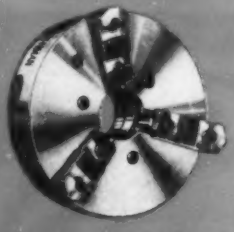
D-5355

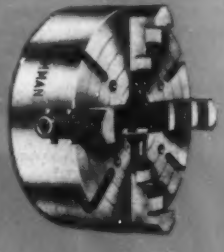
GOOD CHUCKS
keep your
machine tools
at PEAK EFFICIENCY



CUSHMAN

MANUALLY-OPERATED CHUCKS





No machine tool can perform better or maintain closer tolerances than the chucks with which it is equipped. That is the simple reason why we at Cushman emphasize PRECISION in every detail of our production. Experienced engineering, with years of work-holding "know-how," finest modern manufacturing equipment, and exceptional inspection and test procedures, stand back of Cushman Chuck performance.

Good chucks protect your investment in high production equipment... help maintain peak production... conserve skilled man-power. Specify Cushman... A WORLD STANDARD FOR PRECISION.

Cushman Manually Operated Chucks are described and listed in Catalog No. 64TE... Cushman Air Chuck Catalog No. PO-64TE lists separately our complete line of Air Chucks, Cylinders and Accessories.

Either or both will be sent on request.

THE CUSHMAN CHUCK COMPANY
HARTFORD 2, CONNECTICUT, U. S. A.
Chucking Engineers Since 1862

Manufacturers of
AIR CHUCKS, CYLINDERS, and ACCESSORY EQUIPMENT • THE CUSHMAN POWER WRENCH • CUSHMAN MANUALLY OPERATED CHUCKS and FACE PLATE JAWS.

A WORLD STANDARD FOR PRECISION

The new ALLEN BUTTON HEADS are here

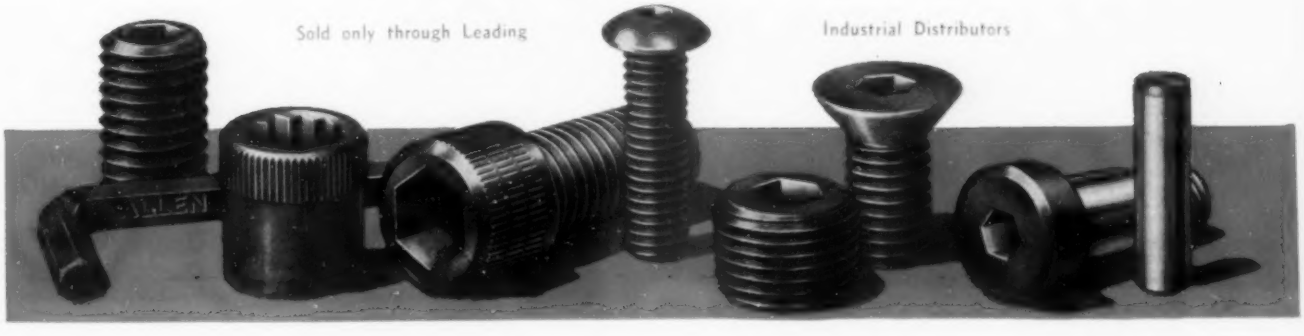
. . . and ALLEN ⬡ SOCKETS have the strength to make this new type practical

Button head cap screws provide smooth streamlined surfaces which are desirable in many applications that do not permit countersinking. However, their sockets are necessarily shallower than those of standard socket cap screws.

This makes it doubly important to be certain you specify genuine *Allen ⬡ Button Heads.* The basic superiority of Pressur-Forming and Allenoy steel provide ample socket strength for satisfactory use, even with the shallower socket.

Sizes from #8 x 1/4" through 5/8" x 2" standard with NC threads. These sizes also standard with NF threads except in 1/2" and 5/8" diameters.

Sold only through Leading Industrial Distributors



check these advantages of

REYNOLDS ALUMINUM

CAST PLATE AND BAR

To lower your Tool, Die and Fixture costs

Surface Machined

All plate and bar is surface milled to closer tolerances on thickness and flatness, reducing fabrication machining.

Precision Cast and Engineered

Advanced casting technique and control eliminates internal shrinks or voids—holds inclusions to an absolute minimum.

Fine, Dense Grain Structure

Better die finishes, easier machining and reduced wear are made possible.

Low Cost

Low material cost, fabrication savings and high salvage value offer economies in experimental and short-run work and, in some cases, production runs. Machine-tool fixtures can be fabricated by inexpensive welding. Aluminum dies can be easily welded or repaired, cutting maintenance costs.

Light Weight

Aluminum, weighing only one-third as much as steel or zinc-base metals, saves labor in tool change-over, often eliminates the need for hoists, reduces handling and storage costs.

Fast, Free Machining

Free machining cuts die fabrication time 40-60%, permits closer tolerances, reduces costs.

Better Die Lubrication

Cast structure offers better wetting and lubricant film retaining properties for forming.

Excellent Thermal Characteristics

Aluminum's high conductivity and rapid heat dissipation minimizes localized heat buildup due to friction and forming stresses.

Wide Range of Standard Sizes

Enables ordering your requirements with minimum waste and simplified fabrication of tools, dies and fixtures.

For full details on Reynolds Aluminum Cast Plate and Bar, call your nearby Reynolds office listed under "Aluminum" in the classified telephone directory, or write Reynolds Metals Company, 2525 South Third Street, Louisville 1, Ky.

Write for free brochure, "Reynolds Aluminum Cast Plate and Bar for Machine Shops, Foundries and Pattern Shops."

SEE *"Mister Peepers"* Sundays, NBC-TV. HEAR *"Fibber McGee and Molly"* Tuesdays, NBC-radio. Consult local listings for time and station.

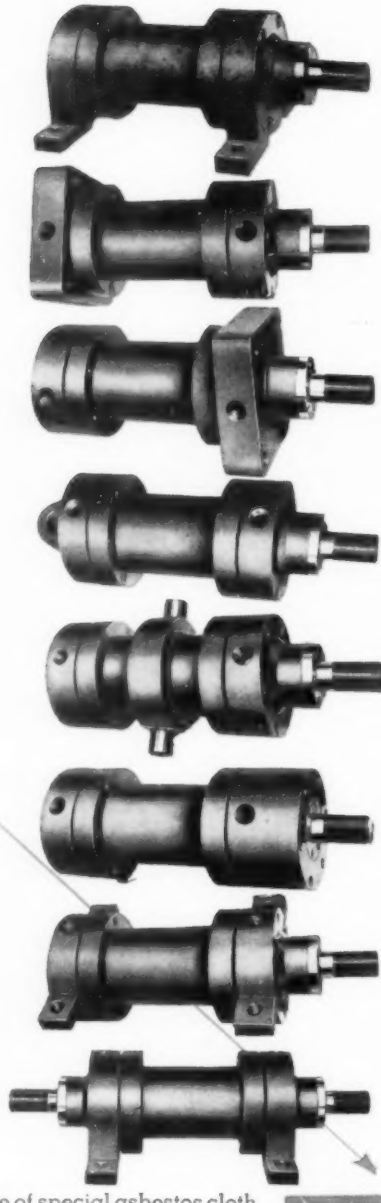
REYNOLDS ALUMINUM

MODERN DESIGN HAS ALUMINUM IN MIND

LINDBERG
HYDRAULIC CYLINDERS

. . . now available for pressures to 3000 PSI

For extra power applications, it'll pay you to investigate the new Lindberg line of hydraulic cylinders for operation up to 3000 PSI . . . ruggedly and heavily designed for extra performance. Added to the 1500 PSI hydraulic cylinders, this line gives you a selection from 0 to 3000 PSI . . . and supplements the Lindberg line of air cylinders.



Check these Lindberg features for dependable, low cost power for lifting, forcing, pulling, pressing, pushing and clamping:

ROTATING CAPS . . . Caps can be easily rotated in order to position ports for piping. Just remove cap screws, and revolve head cap . . . it isn't necessary to disassemble cylinder. This feature permits simplified piping, and frequently eliminates need for T-fittings or elbows.

NO TIE-RODS . . . Welded flange construction eliminates need for tie-rods . . . insures proper alignment.

PACKING RESISTS OIL AND TEMPERATURE . . . Chevron type piston rod packing is made of special asbestos cloth and rubber compound . . . resists high temperature . . . is not affected by oil.

NEOPRENE O-RINGS . . . Conventional gaskets are replaced by Neoprene O-rings. Sealing action is automatic . . . the higher the pressure, the tighter the seal.

SOCKET-HEAD CAP SCREWS . . . All screw heads are in the open and easily accessible from outside the cylinder. It is not necessary to partially disassemble cylinder to tighten screws.

Lindberg 3000 PSI Hydraulic Cylinders come in 8 mounting types and 10 bore sizes from 2" to 8".

New 28-page bulletin, No. 701 carries detailed drawings of both 3000 and 1500 PSI cylinders . . . chart-tables show bore sizes, pressures, etc., ask for your copy, today.

LINDBERG AIR & HYDRAULIC DIVISION

Lindberg Engineering Company · 2447 West Hubbard Street · Chicago 12, Illinois

We Would like to "Hand it to You"...

This Complete Package of Metal-Working "Know-How"

Yes! Here is one of the nation's outstanding engineering departments ready to go to work for you!

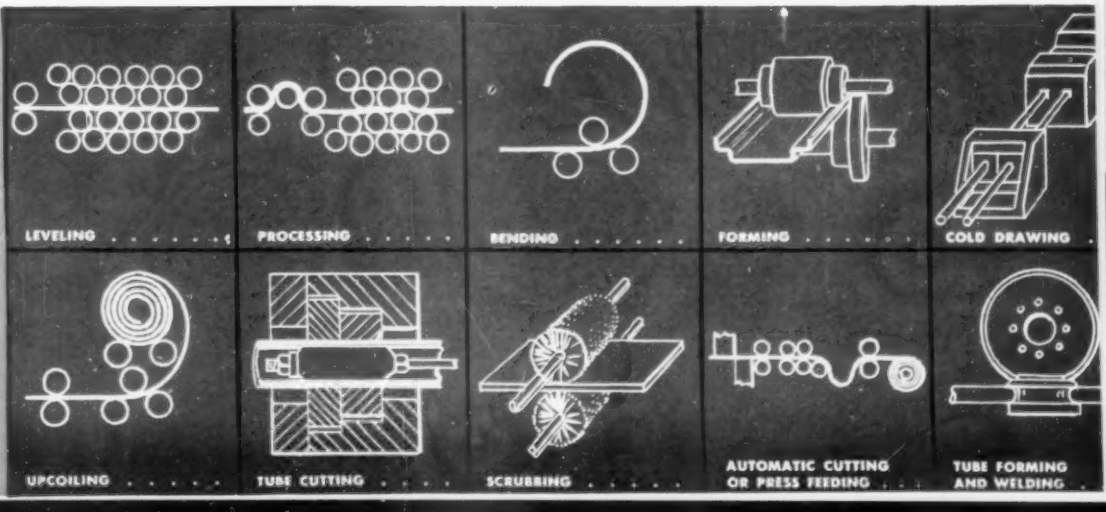
Many of the country's more aggressive manufacturers now regularly specify metal-working equipment designed and developed by these engineers.

If your production equipment is slow, inefficient, old and expensive-to-operate, and you would like the finest in modern, high-speed, labor-saving machinery for leveling, processing, bending, forming, cold drawing, coiling, cutting, or feeding of **steel and non-ferrous metals**, put this top-flight, problem-solving crew to work for you now. Just call or write

McKAY MACHINE COMPANY, YOUNGSTOWN, OHIO.

YOU CAN'T BEAT
McKAY-Built
METAL-WORKING
MACHINERY
WHEN IT COMES TO . . .

McK



Index of The Tool Engineer Advertisers

June, 1953, Issue

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♦User of ASTE Data Sheets

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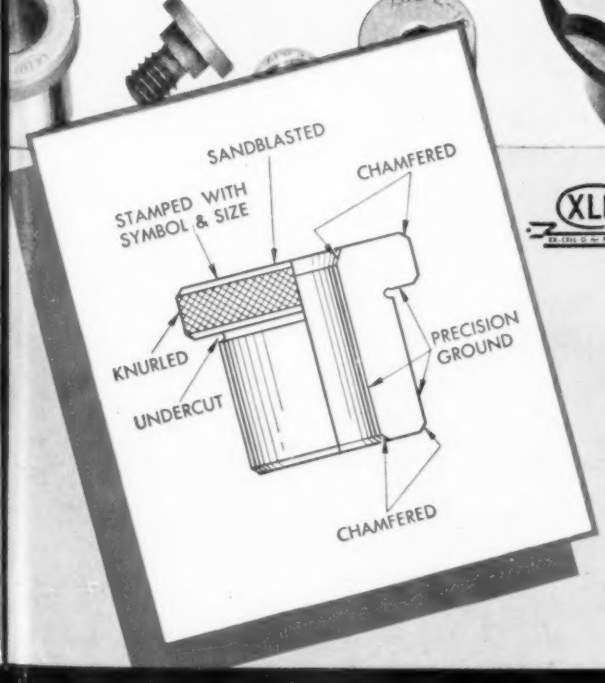

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